

# Design News

**Working model mechanically demonstrates human circulatory system. Page 8**



A CAHNERS PUBLICATION

OCTOBER 27, 1961

## NEW—TWO LOW-COST MINIATURE BALL BEARING LINES

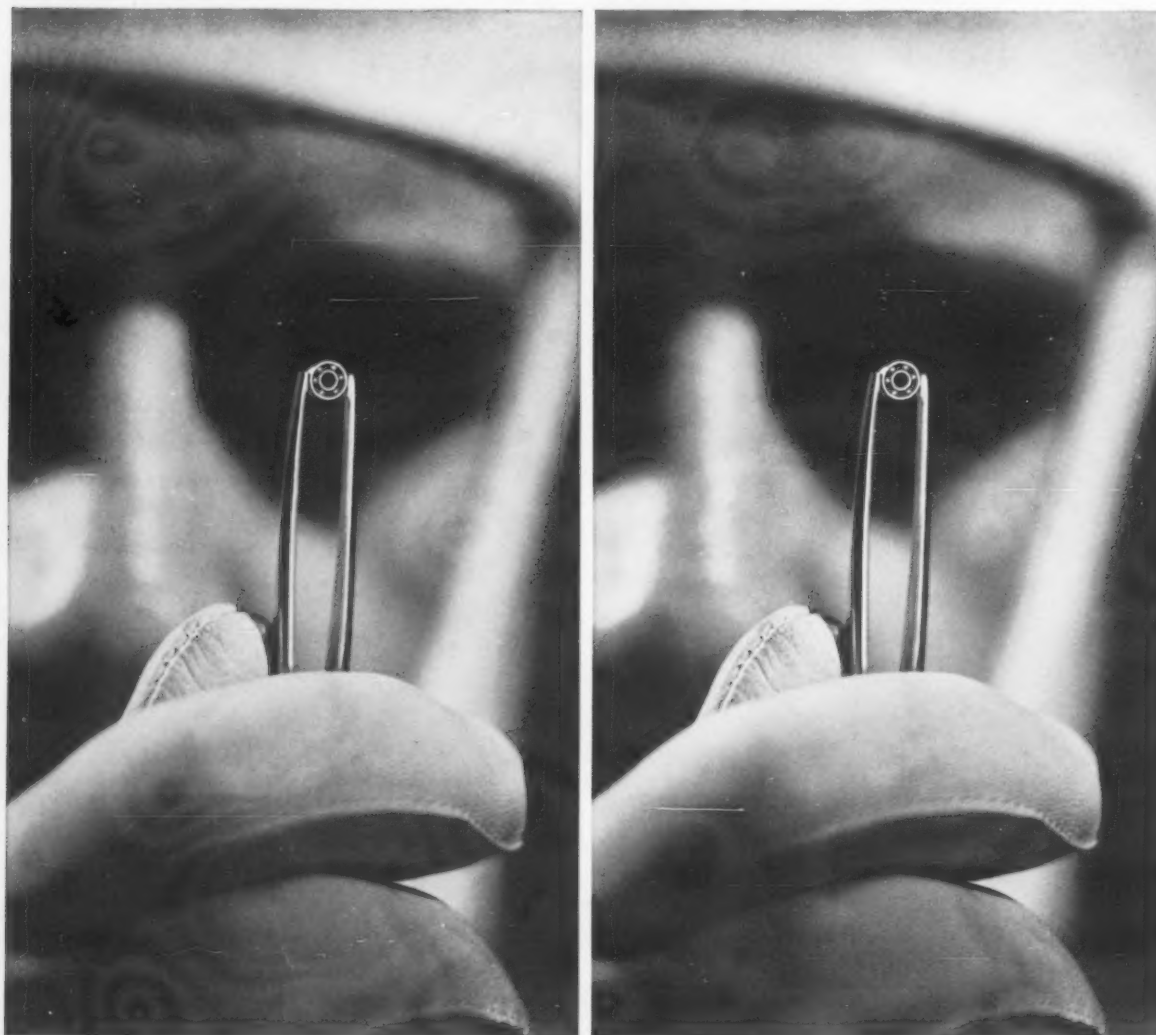
New Departure ABEC 3\* and ABEC 5\* miniature ball bearings now offer manufacturers of precision miniature potentiometers, gear trains, motors and similar precision products the opportunity to reduce bearing costs substantially.

New Departure ABEC 3 and ABEC 5 bearings can be used wherever the high precision and performance of ABEC 7 bearings are not required. They offer the engineer greater design versatility—he can select the most economical bearing for each application. Moreover, New Departure ABEC 3 miniature ball bearings can be used to upgrade products presently using precision sleeve bearings.

New Departure will continue to offer super precision ABEC 7 miniature ball bearings for your highly critical applications.

If you are planning a re-evaluation of your miniature bearing applications, it will pay you to consult the N/D Sales Engineer in your area. His assistance may help pave the way to reduced parts cost or enhance the quality of your product. For more information, write for booklet AST, NEW DEPARTURE, DIVISION OF GENERAL MOTORS CORPORATION, BRISTOL, CONN.

\*Bearing tolerances as established by the Annular Bearing Engineers Committee of the Anti-Friction Bearing Manufacturers Assoc.



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**Design News**

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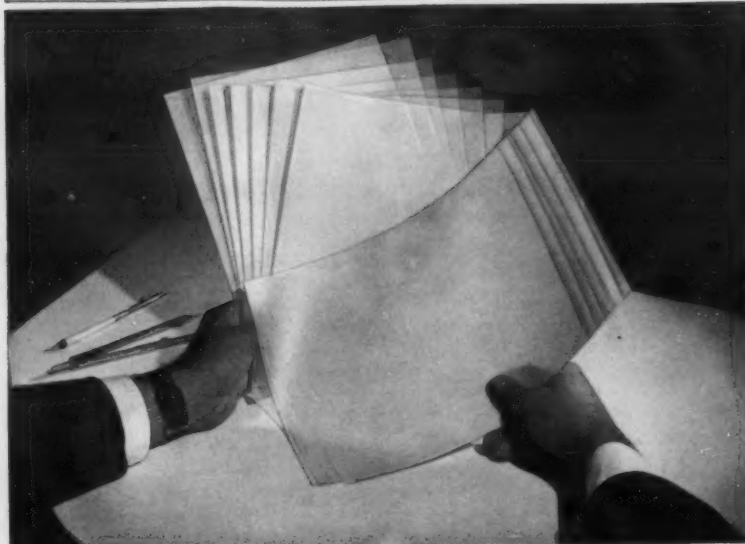
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# DRAFTING TRENDS



Appearance is not a good indicator of drafting film workability or reproduction quality—see test offer below.

## In drafting films, it's the coating that counts

### Film Similarities

All drafting films share one common characteristic—every major brand employs a polyester base. This polyester material may vary somewhat in grade (from clear to milky) or in gauge (from .002 to .007). However, its properties remain so nearly identical that no appreciable difference in print-back speed can be noted by exposing diazo material through the uncoated film. Accordingly, all polyester films have these unique features: dimensional stability, transparency, flexibility, moisture-resistance and tear strength.

### Coating Differences

These advantages mean nothing to the engineer, draftsman or architect until a surface receptive to pencil and ink is put on the film. Post applies three distinct micro-coatings to its polyester film, baking these elements and the film at such high temperatures that they are literally fused. This process also "pre-shrinks" the material, endowing

Polytex with slightly greater dimensional stability.

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The net result of the exclusive Post coating process is the most durable drafting film surface available—a surface on which, if circumstances demand, you can use the hardest grade of pencil without destroying the coating. Some pencils work better than others, of course. Plastic-based pencils are best of all when permanence or washability are considered.

### Test Offer

To convince you, regardless of previous or present drafting film experience, that Post Polytex offers a superior coating with outstanding erasability, pencil and ink adhesion, a free Polytex test kit is yours without obligation. We'll mail an 8½ x 11 drafting film sample, plus a vinyl eraser and drafting pencil assortment, packed in a Post Pocket Protector. Write for it on your letterhead today. *Frederick Post Company, 3650 N. Avondale Avenue, Chicago 18, Ill.*



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ENGINEERING EQUIPMENT & DRAFTING SUPPLIES • FIELD EQUIPMENT & DRAFTING FURNITURE

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## SOUNDING BOARD

FOR OUR READERS



### Research Results Available

We are interested in your editorial in the Aug. 4 issue of *DESIGN NEWS* as regards the availability of the results of government research.

As manufacturers of gas engines and piston compressors, we would appreciate information on papers concerning the design and stressing of crankshaft for long life operation.

A. S. LAMB  
Design Engineer  
Clark Bros. Co.  
Olean, N. Y.

In the Aug. 4 issue of *DESIGN NEWS*, I noticed an article entitled "Research Results Dirt Cheap". I am interested in obtaining documents from the Office of Technical Services on subjects of a technical nature covering such fields as metallurgy, welding techniques and corrosion resistance of various alloys used in the aircraft industry.

I am wondering if you could supply me with a title list of the research reports available.

D. H. HOOPER  
Specifications Engineer  
Meletron Corp.  
950 N. Highland Ave.  
Los Angeles 38, Calif.

This comes from a constant and avid reader of your excellent periodical. I have just finished reading about OTS and it occurred to me that perhaps someone has done some work on granite properties. I am using granite for machine elements because of its mass and damping qualities but I have no good experimental data on properties. Can you or OTS steer me in the right direction?

WILLIAM A. REAGAN  
3769 Iroquois Ave.  
Long Beach 8, Calif.

In reference to your article in *DESIGN NEWS* of Aug. 4, 1961 (page 3), I would like to have more information on the Office of Technical Services.

How can I write to the above service and obtain a list of available publications in a specific field? My particular interest is in hydraulic controls for machine tools.

Our company has developed a numerical control system, without tape, for a turret lathe, drill table, etc. Any research data we can obtain in this field would permit us to expedite future development programs.

THOMAS P. NARDO  
Hydraulic Staff Engineer  
Specialties, Inc.  
Skunks Misery Rd.  
Syosset, L. I., N. Y.

• A list of available reports may be obtained by writing James E. Wheat, Jr., Chief, Publications & Public Information Div., U. S. Dept. of Commerce, Office of Technical Services, Washington 25, D. C. Or, you may wish to contact your nearest U. S. Dept. of Commerce office.

### War in Materials

Regarding your editorial, "War in Materials":

1. Material selection is a compromise between cost, strength, wear rate, appearance, surface finish, thermal stability, and time and humidity stabilities.

2. Errors in material selection are errors mostly due to ignorance in the areas of real cost (this means cost including all tooling), wear rates, optimum surface finish and optimum lubrication.

3. The major reason for errors is not so much individual ignorance as it is general ignorance. For example: a part may be made from high-alloy steel, heat treated and ground to a very fine polish, when in fact a "Ledloy" steel, sand-blasted to 20-mil surface and carbonitrided, would give superior performance at perhaps 1/4 the cost. Another error seen every day is the specifying of high-alloy steels and elaborate heat treatments to increase rigidity, when neither alloys nor heat treatments have any great effect on rigidity.

The average sales engineer is interested, naturally, in selling his own product. How difficult it is to get engineering data resulting from independent and adequately controlled testing of engineering materials! It is especially difficult to get data in the area of wear rate, optimum surface finish and optimum lubricants. Most plants lack adequate feedback from purchasing and manufacturing engineers who know costs to design engineering departments. Most design engineers know very little about the comparative wear rates of materials. How ignorant we are! I'm looking forward to your issue of the 29th.

F. W. KINSMAN, P. E.  
2815 Baird Rd.  
Fairport, N. Y.

### Decline and Fall

Re: Your editorial "Decline and Fall" that appeared in the June 19, 1961 issue of *DESIGN NEWS*, I would like a reprint of your editorial and would like permission to submit it to the editor of the *Cincinnati Enquirer* for publication in that newspaper.

I think that the editorial is historically timely and that maybe the chairman of our FCC, Newton Minow, might appreciate a copy.

DOUGLAS K. FLANARY  
Engineer's Assistant  
Norwood Development Lab.  
Allis-Chalmers Mfg. Co.  
Milwaukee 1, Wis.

• Copy of editorial sent and permission granted to reprint it.



## DESIGN VIEWS

### 'Governmentese'

"This invention relates generally to high-speed actuators and more particularly to an extremely rapid actuating mechanism employing solenoid triggering mechanisms in conjunction with an air cylinder mechanical energy-storing arrangement whereupon the closing of an electrical circuit initiates a nearly instantaneous mechanical action to axially displace a rod member from one position to the other."

The above paragraph is taken verbatim from a recent U. S. patent. To be completely fair about it, I picked out what I considered to be the most readable patent of a large number we had on hand.

Do you thoroughly understand what this paragraph says on first—or even second—reading? I required three readings to understand what the author said. Just for fun, you might wish to compare the original description against our own version on page 32 of this issue.

I think this kind of writing is a symptom of one of our major problems. I wonder how many man-hours are lost every day while people try to decipher what someone else is trying to communicate? The total must be staggering.

The title of this editorial was not chosen without reason. While much of the literature published by, or for, the government is written in this general style, the government alone cannot be held responsible. The problem is far deeper, somewhere in the realm of human psychology. It is far too easy to blame a nameless identity like the government when we are ourselves responsible. The entire technical community is guilty of using "governmentese".

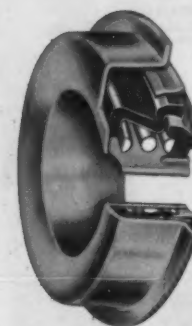
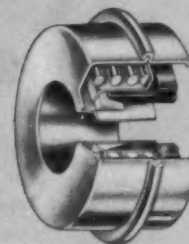
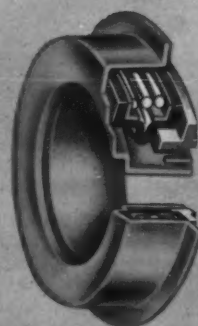
Just a few extra minutes spent in eliminating useless long words and sentences can save untold man-hours at the other end of the communications link. Take a research report, for instance. Assume that it must be read by 20 people. Just 10 extra minutes, well-spent by the writer in clearing up his style, will save at least that much of each reader's time. That means 3.3 man-hours saved at the other end.

It doesn't take a genius to write simply. But "governmentese" is the mark of the egocentric. Let's clear up our technical communications.

*J. P. Dubois*

Executive Editor

## Shaft Seals That Cut Original Equipment Costs



Every problem of the manufacturer has been taken into consideration—from production line requirements to the cost of components in the pricing of the end product.

## THESE ARE SOME OF THE ADVANTAGES YOU CAN PLAN ON WHEN YOU USE JOHN CRANE PRODUCTION SHAFT SEALS:

**ECONOMY**—Low unit cost is achieved through mass production methods.

**FAST, EASY INSTALLATION**—Unit construction permits them to be quickly pressed into position.

**MINIMUM STOCK**—Four sizes,  $\frac{3}{8}$ ",  $\frac{1}{2}$ ",  $\frac{5}{8}$ " and  $\frac{3}{4}$ " can be used for all intermediate shaft diameters to  $\frac{3}{4}$ "

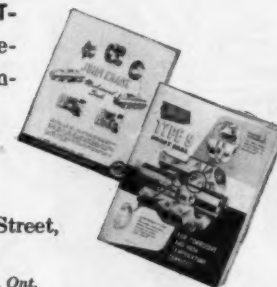
**ALL SERVICE CONDITIONS**—Only three types are needed to cover all services . . . water to destructive acids, temperatures from  $-100^{\circ}$  to  $+500^{\circ}$  F. . . pressures to 150 psi.

**RECOMMENDATIONS AND ASSISTANCE**—Tell us about your requirements. We will be glad to give recommendations or provide assistance.

For general information ask for Bulletins S-216 and S-205-3.

Crane Packing Company, 6423 Oakton Street, Morton Grove, Ill. (Chicago Suburb).

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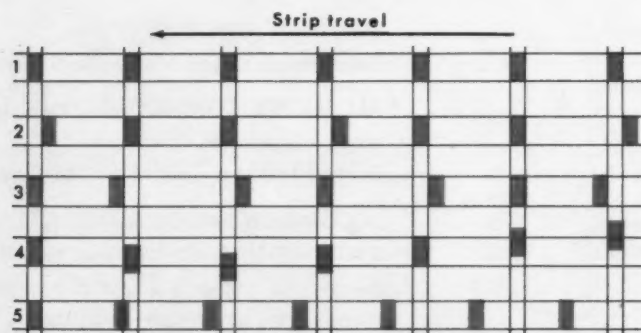
## Registration of Printing and Stamping for Continuous Metal Strip

R. J. Kieckhefer, Jr., Vice President, Litho-Strip Corp., Chicago, Ill.

Continuous coil register printing provides a way to synchronize operations performed in the printing and the fabricating plant. It usually refers to printing with reference holes or with register eye marks that can be picked up by photoelectric cells. The register control directly governs the feed mechanism of the punch press or other tools used in the final forming operation.

Major inducements for going into register printing on coil stock are:

1. Feeding equipment on punch presses is much less expensive and easier to maintain.
2. A roll-fed, progressive die assembly may be employed on coil where some transfer setup is required if sheet is used.
3. The typical progressive die assembly operating with roll stock may be operated up to three times as fast as a transfer die.
4. Less skill and time are required to set up and maintain a progressive die assembly.
5. Coil stock may be processed through coil-coating equipment and in the same operation subjected to other surface chemical treatments which provide improved adhesion and corrosion resistance.
6. Scrap metal loss is reduced, especially in the blanking out of circular parts.
7. Coil printing precludes damage and scrap loss, especially



1. Perfect register
2. Cyclical error every third impression
3. Random error
4. Transverse (tracking) error
5. Cumulative error

EFFECT OF REGISTER ERRORS (EXAGGERATED)

REGISTER HOLE METHOD of register printing.



LITHO-STRIP 24-inch coil printing line.

critical in aluminum because of shock as the work is ejected and when it is stacked.

### Methods of Register Printing

1. The Register Hole Method—More accurate register is obtained and error correction requirements of the punch press are reduced compared to where eye marks are used. The maximum error remains well within the error in pin clearance in the progressive die. This method is particularly adaptable to use in progressive die operations where the strip between progressions is relatively stiff and corrections are correspondingly difficult to introduce.

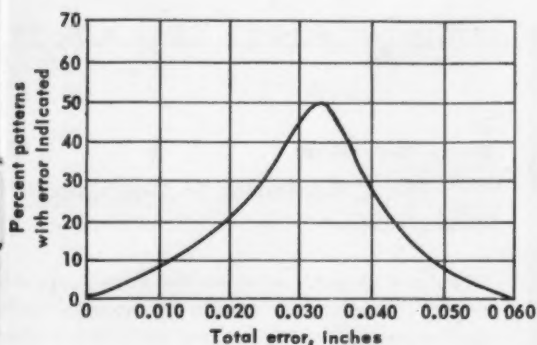
2. The Eye Mark Method—This is the less expensive method. It is adaptable to both big and small parts. Continuous printed strip in widths from 1 to 66 inches and repeat lengths up to 40 inches may be used if register is maintained by the eye mark method. Upper limits with the register hole method currently are 14-inch widths and repeat lengths up to 14 inches.

### Register Printing Limitations

Four chief sources of error in printing are:

1. Errors resulting from inaccuracies in the original, errors introduced by the copying lens and step and repeat mechanisms of the camera and errors caused by shrinkage in the transfer film





**TYPICAL DISTRIBUTION CURVE** of register error in run of commercial parts.

during processing. Composite effect of these inaccuracies is that, in a first-quality commercial printing cylinder, allowance must be made for positioning error of about one part in 1000 with a lower limit between 0.010 and 0.015 inch.

This composite error appears both lengthwise and crosswise in the finished product as a cyclical error repeating at a frequency equal to the number of patterns around the printing cylinder. It is relatively easy to detect and measure because of its reproducibility and short period.

2. Errors caused by mechanical tolerances in the equipment that meters the strip to the printer, including creep on feed rolls and changes in strip length which are attributable to variations in tension and temperature. They appear as a cumulative error in repeat length and amount to an inaccuracy of about one part in 1000. This error is relatively constant and appears always in the same direction and parallel to the travel of the strip.

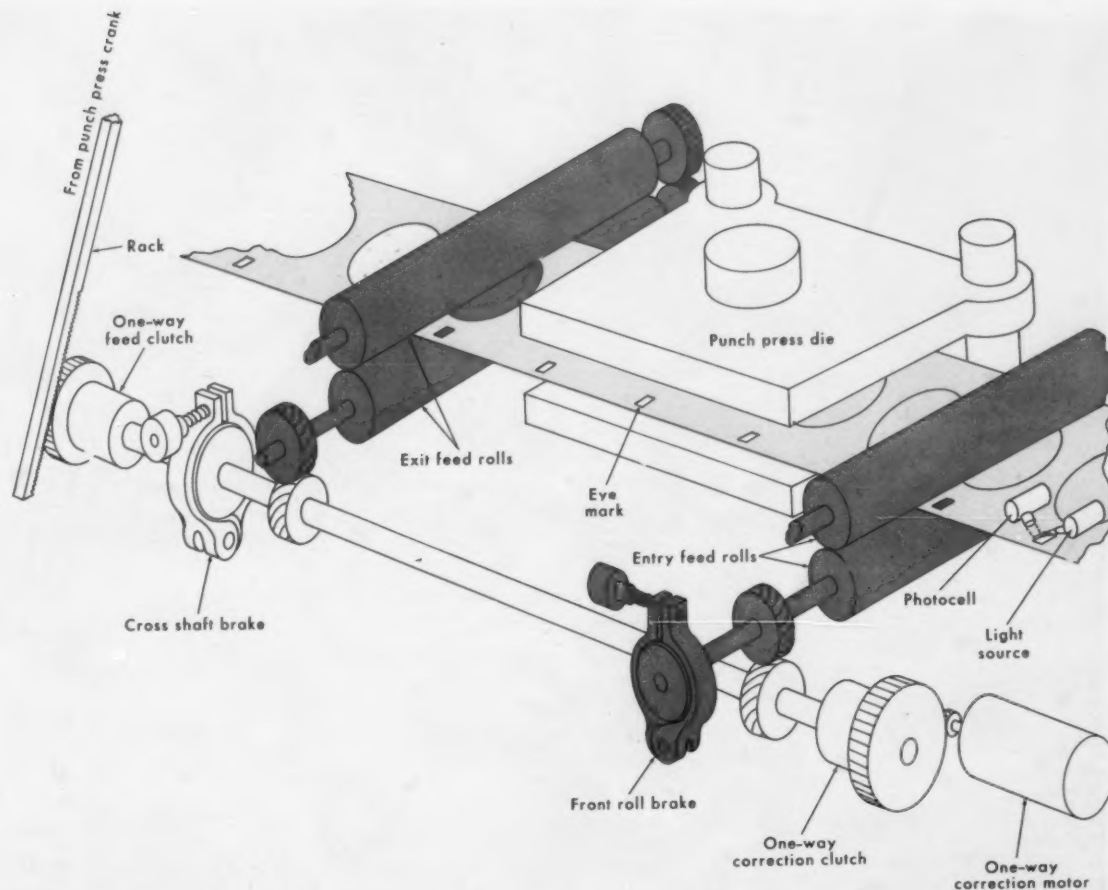
3. A random error resulting from variations between strip speed and printing plate speed traceable to slip in printing press in-feed, gearing errors and backlash. This error, always parallel to the strip travel, is of the order of one part in 500.

4. An error in printing placement across the strip caused by guiding (tracking) error and camber in the strip. This will amount to an inaccuracy of about  $\pm 0.015$  inch on flat strip, but can be much greater if there is a marked camber in the strip.

Cumulative effect of the several printing errors follows a normal distribution curve. In a typical job with a maximum total positioning error of about 0.030 inch, the composite error will average about 0.010 inch, with about 75 percent of the work printing to accuracy within 0.015 inch. Choice of register control required on the punching or forming equipment is affected also by the rate of change of error.

#### **Punch-Press Register Controls**

There are two types in common use today. One compares a signal from a photoelectric cell and corresponding amplifier during the feed stroke with a timed signal from a rotary switch turned by the punched press. The other measures output of the



**PHOTOELECTRIC SCANNER** used with punch press with four-roll feed and one-way correction device.

photoelectric cell while the feed is stopped and compensates before or during the next stroke.

In punch-press register, three classes of errors may be considered:

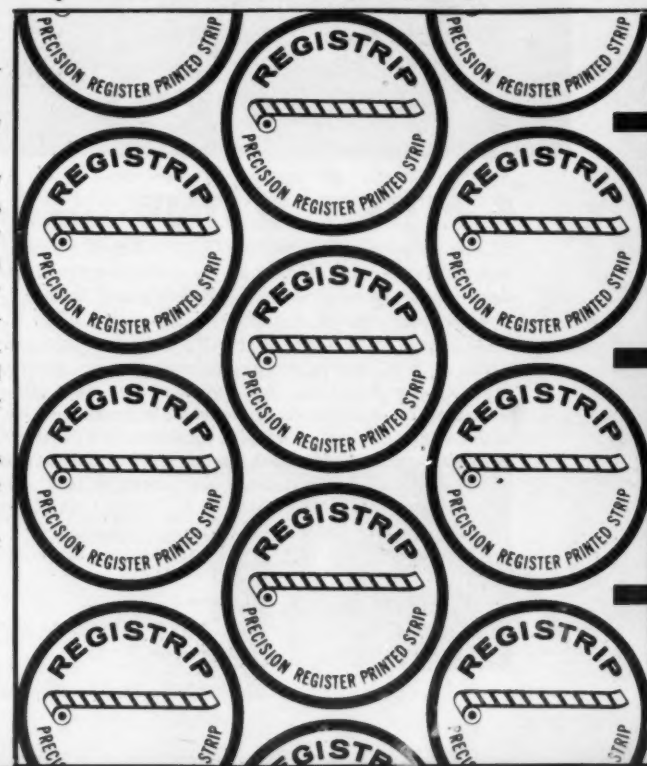
1. Error because of limitations in the sensitivity of the photoelectric cell. The basic problem stems from the fact that scanning heads project a relatively large area of the strip onto the photoelectric cell in proportion to the magnitude of the error to be controlled and the cell responds to the average intensity of the light reflected from the entire area. Anything that changes the amount of light reflected will change the point at which the cell reacts to the edge of the mark.

2. Error attributable to timing switches. Analysis by oscilloscope often has revealed surprisingly large errors from this source.

3. Errors introduced by the error-correction device itself.

Properly used, register printing combined with photoelectric controls can produce substantial economies available by no other means.

#### **EYE MARK METHOD** of register printing.





## A STITCH IN TIME.....

... can fly missiles on schedule ... keep planes flying ... and sustain industrial operations. Delays due to calibration verification of pressure sensing devices can now be eliminated completely with the use of Futurecraft's new "Cali-System" method of pressure calibration.

"Cali-System" now makes it possible to calibrate any pressure sensing device such as transducers, gauges, switches, etc., without removing them from the system and even while the system is functioning under full pressure. One man can carry the whole system — one man can operate it with complete safety ... without contamination ... in a fraction of the time normally required. Accuracies of one tenth of one percent over a pressure range of 0 to 10,000 PSI. Service and cost proven on such projects as Titan, Atlas, and Minuteman. Let us show you how to benefit from the amazing capabilities of "Cali-System" ... write ... for information today.



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## SEEN AND HEARD

### The Other Way

(With Apologies to Machiavelli)

While it is generally accepted that talent, devotion to duty and loyalty are among the necessary qualities for the attainment of success, let us also understand there is "another way". Nearly every organization has a few who travel this route.

In case you too find yourself short on talent and long on intrigue, here are a few basic rules of success via the "other way".

1. Don't even make a decision if you can get out of it. If something turns sour, make sure someone else is responsible for it.

2. Don't give anyone a chance to rectify his own mistake. Let the boss know right away that Joe had to back track a little today on his job.

3. Don't bring the boss any bad news yourself, and don't let anyone else bring him the good news. Make sure he sees your smiling face when he hears what he wants to hear.

4. Appoint yourself as unofficial office spy. Whisper choice tidbits of current gossip and always leave with the admonition that there's something big brewing that the boss should know about.

5. When someone else does a good job, shrug it off with—"Well, that's what he's paid for, isn't it?"

6. Knock the company (confidentially, of course) when talking to your associates or subordinates. You can get rid of a lot of competition by ruining the office morale.

7. Flatter your superiors at every opportunity. Don't disagree with their decisions, even if you know they are wrong.

8. Keep track of the blunders and bad jobs of others and bring them to recall at every opportunity.

9. Don't let your subordinates know what you are doing. This is basic job insurance.

10. If your subordinates do a good job, accept the credit. If they do a bad job, pass on the blame.

11. Second guess the other fellow's jobs. You can always come up with ways in which he should have done things to save money, time and material. Second guessing is relatively safe once a job has been shipped.

12. Watch for who comes in late, who leaves early, who stretches the lunch hour, who loiters in the washroom, who uses too many pencils, paper or other material or who joggles the thermostat and then complain indignantly.

Lars G. Soderholm,  
Midwest Editor



13. Cozy up to the "wheels" during off hours. See if you can't buy them a drink, ask them out to the house or get in a little golf. If you're going to stick a knife into someone's back, the off hours are best to do so. The fellow won't even know he's been stuck until much later.

If you follow this list of rules, you either will be chased bodily out of the department or will become a well-hated boss. In case you get thrown out and have remembered the rules, don't despair; you still will have all of the qualifications of a villain and thus a promising career in TV.

### Hydraulic Seminars

Early in September a High-Pressure Hydraulics Seminar was held at Dynex, Inc., at Pewaukee, Wis. While this meeting was slanted primarily at the use of this company's high-pressure components, it was nevertheless a good show.

The component that aroused the most interest was the split-flow pump having simultaneous variable and fixed flow outlets. Each pump cylinder is allowed to function as an individual pump whose displacement can be varied if necessary by an internal valving arrangement. This means one piston pump can have many outlets from individual or manifolded cylinders, some with fixed displacement and others with variable displacement.

Later in September, a Hydrostatic Transmission Seminar was held at the Milwaukee School of Engineering in Milwaukee, Wis. The participants were greeted aptly by Wesley R. Master (Dynex) with, "Hello, fellow competitors." Dr. Warren E. Wilson (Harvey Mudd College) spoke on the "Theory of (Ideal) Hydrostatic Transmissions".

At both gatherings it was interesting to note the close-mouthedness of some in the group. There's plenty in the works—especially with regard to hydrostatic transmissions. The time of presentation of some of these "goodies" is being delayed by the secretiveness of the companies doing the developing. I am fortunate in having gained the confidence of many individuals and many organizations (a confidence, incidentally, that I respect completely), and I can assure you that most secrets are imagined rather than real.



The new patented counterbore knurl provides a more acute angle of entry for deeper penetration and greater knurl contact—hence maximum vibrational holding power.

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That, in a phrase, is the UNBRAKO set screw with patented\* counterbore knurl—a fastener of unparalleled vibrational holding power.

A direct evolution of the already proven UNBRAKO knurled cup point screw, the new UNBRAKO High Torque permits your design ingenuity extraordinary freedom. No need now for the redundancy of two set screws because you're afraid one will work loose. No need to sacrifice the adjustability of a set screw for a permanent pin fastening.

As you see from the illustrations, with the counterbore knurled cup point, the angle at the point of entry is extremely acute. This permits easier and deeper penetration, greater knurl contact. The result is a positive locking action *before* . . . and unparalleled vibrational holding power *at* the recommended seating torque.

In addition to the counterbore knurl, the new UNBRAKO High Torque offers another advance unique among set screws—the Hi-Life Thread. A smoothly radiused thread root not only distributes stresses to permit significantly higher tightening torques, but also adds metal to this critical area between the root of the thread and the extra-deep UNBRAKO socket.

Make sure your designs get the reliability they deserve. Specify UNBRAKO—"the one that won't work loose."

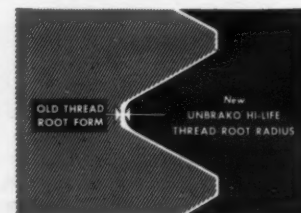
The new UNBRAKO High Torque Set Screw—with counterbore knurl and Hi-Life threads—comes in sizes #4 through 1 in. Your authorized UNBRAKO distributor has a complete supply on hand *now*. For a copy of our new booklet on UNBRAKO High Torque Set Screws, write to Standard Pressed Steel Co., INDUSTRIAL FASTENER DIVISION, SPS, JENKINTOWN 6, PENNSYLVANIA.

\*No. 2,992,669—patented July 18, 1961

**SPS**

where reliability replaces probability

Smoothly radiused root of Hi-Life thread distributes stress concentration at critical point, thus making possible UNBRAKO's higher tightening torques.



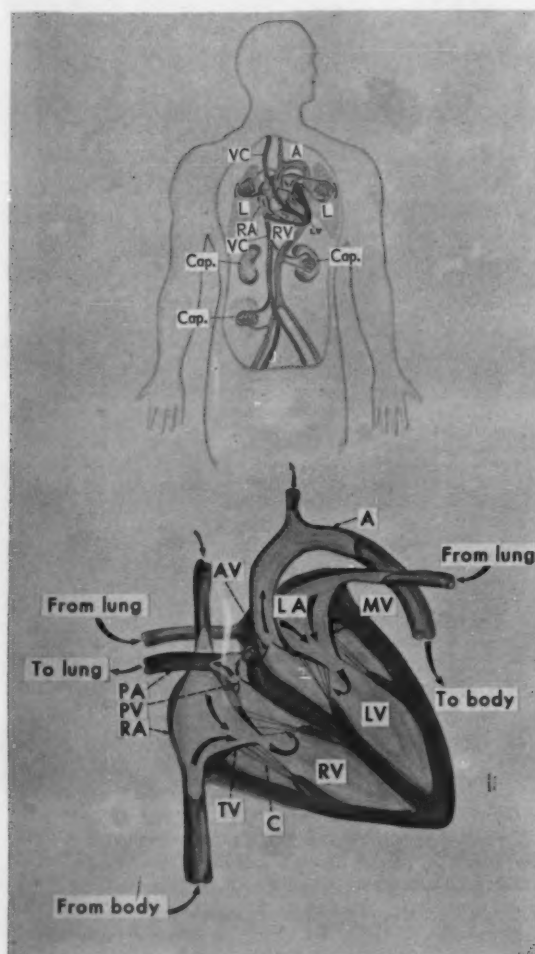
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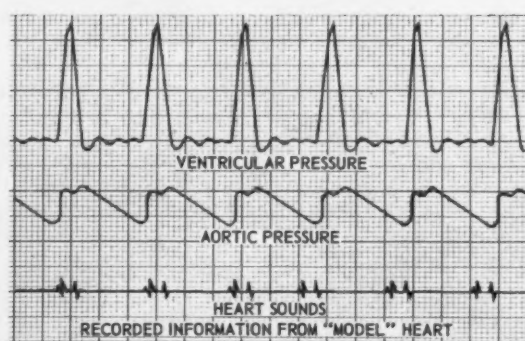
## Working Model Mechanically Demonstrates Human Circulatory System

Lars G. Soderholm, Midwest Editor

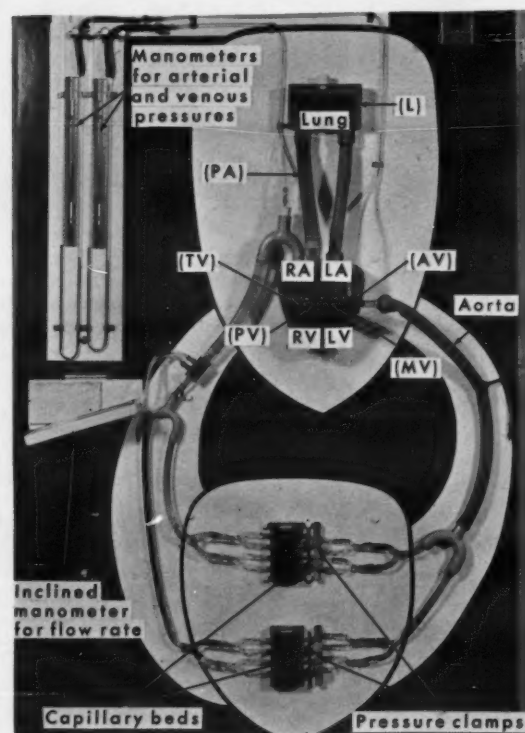


HUMAN CIRCULATORY SYSTEM

**FLOW THROUGH MODEL** can be traced from right atrium (RA) through tricuspid valve (TV) to right ventricle (RV). Right ventricle pumps fluid through pulmonary valve (PV), pulmonary artery (PA), lungs (L) into left atrium (LA). From left atrium, flow is through mitral valve (MV) into left ventricle where it is pumped through aortic valve (AV) into arterial system.



**FUNDAMENTAL HEART SOUNDS** can be heard with stethoscope placed on aorta of model. Through selection of materials and components, a close similarity to the human heart sounds is achieved. During ejection phase of pump cycle, a distinct "lub" is heard followed by a "dub" as the aortic valve snaps closed. The arterial pulse can be felt on the aorta or arterial branches, but is absent in venous system.



A working model of the human circulatory system uses mechanical components to demonstrate the dynamics of blood distribution to the body tissues. The model uses a cam-operated, double-chambered pump as the heart, valves that function realistically; combinations of rubber and plastic tubing to duplicate the aorta and other branches of the circulatory system; foam capillary beds with adjustable clamps to permit an increase in flow resistance as would be caused by constriction of the arterioles, and a "Lucite" chamber filled with polyurethane foam to simulate the lungs.

This working model initially was designed as a teaching aid for the fundamental principles of blood circulation, but it also can be used for advanced studies in cardiovascular diseases and diagnosis. All parts of the model are of clear plastic whenever possible so the path of the blood (tap water with red food dye) can be seen easily. Heart valves are exposed so their action can be seen. Arterial and venous pressures are indicated on manometers and an inclined mercury manometer indicates flow rate from an orifice plate in the large vein. Pumping rate (heart beats per minute) is set through a belt and pulley arrangement while capillary resistance is selected by thumb screws on clamps before the capillary beds.

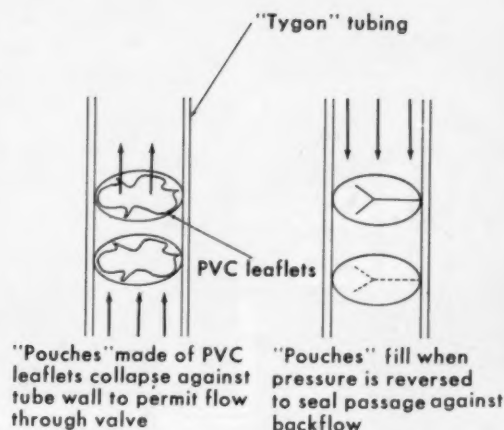
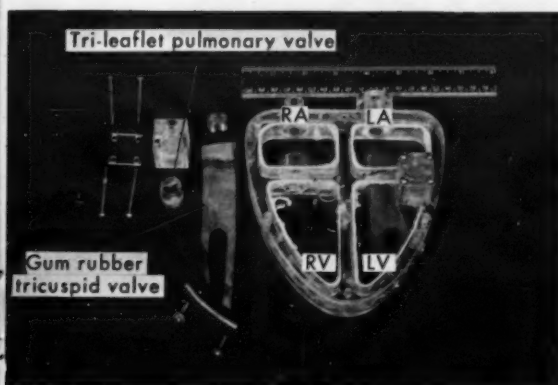
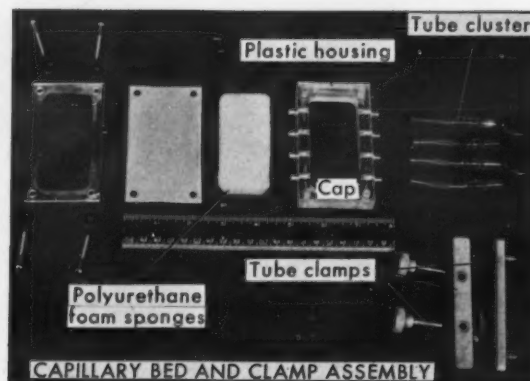
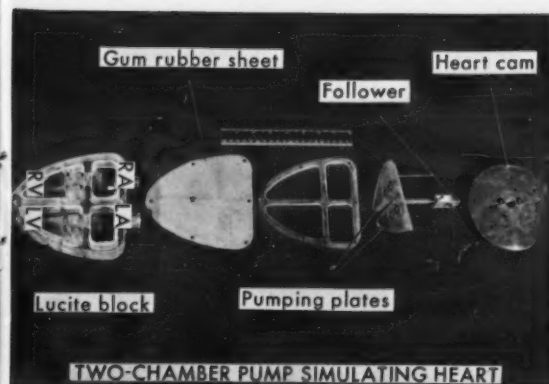
### Heart

The model heart consists of a double ventricular pump with two passive atrial chambers. These chambers are all cut into a "Lucite" block. A gum rubber sheet covers the rear openings so a set of pressure plates, driven through a cam and follower arm from a 1/4-hp motor, can pump by forcing the rubber sheet in and out of the ventricular chambers. Pumping capacity is determined by the cam design which affects pump displacement. The pumping rate is varied by shifting the motor belt on cone pulleys.

The atrial chambers, during operation of the model, act as surge vessels.

### Valves

The tricuspid and mitral valves in the right and left ventricles are made of rubber gooch tubing and are V-cut so as to simulate actual heart valve action. The valves extend into the ventricles and are pre-



TRI-LEAFLET HEART VALVE

vented from inverting into the atria by chords connecting the leaflet ends to the ventricle wall.

The tri-leaflet pulmonary and aortic valves are made by cementing polyvinyl chloride sheet leaflets into slits cut in the wall of "Tygon" tubes. These valves are realistic both in configuration and action.

#### Circulatory System Branches

All blood vessels in the body are more or less elastic, but in the model only the aorta, pulmonary artery and the pulmonary vein are made to be elastic. The gum rubber tubing used is critical since wall thickness, diameter and length all affect the pressure-volume relationship. The aorta, the largest vessel in the body, is made with enough elasticity to permit it to store liquid during the period of cardiac ejection. The pulmonary artery functions in the same manner except the pressure is less, so a short, thin-walled tube can be used.

The other vessels are made of clear plastic ("Tygon") tubing to allow observation since their elasti-

city was not necessary for demonstrating basic circulatory dynamics.

#### Capillary Beds

The major resistance to flow is found in the arterioles leading to the capillaries which deliver blood to all the body tissues. The capillaries divide the flow into millions of short, parallel, low-velocity streams which are simulated in the model by two small polyurethane sponges. To apply resistance, the arteriole tubing is compressed by thumb screws that adjust the clamp position. Each of the two capillary systems can be adjusted separately.

#### Lungs

The lungs are represented by a single "Lucite" chamber of polyurethane foam. In passing through the lungs, the blood meets little resistance.

The working model of the human circulatory system was developed, working on grants from the National Science Foundation, at the Midwest Research Institute, Kansas City, Mo.

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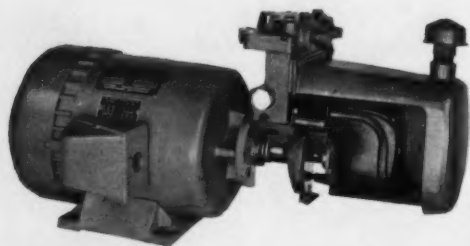
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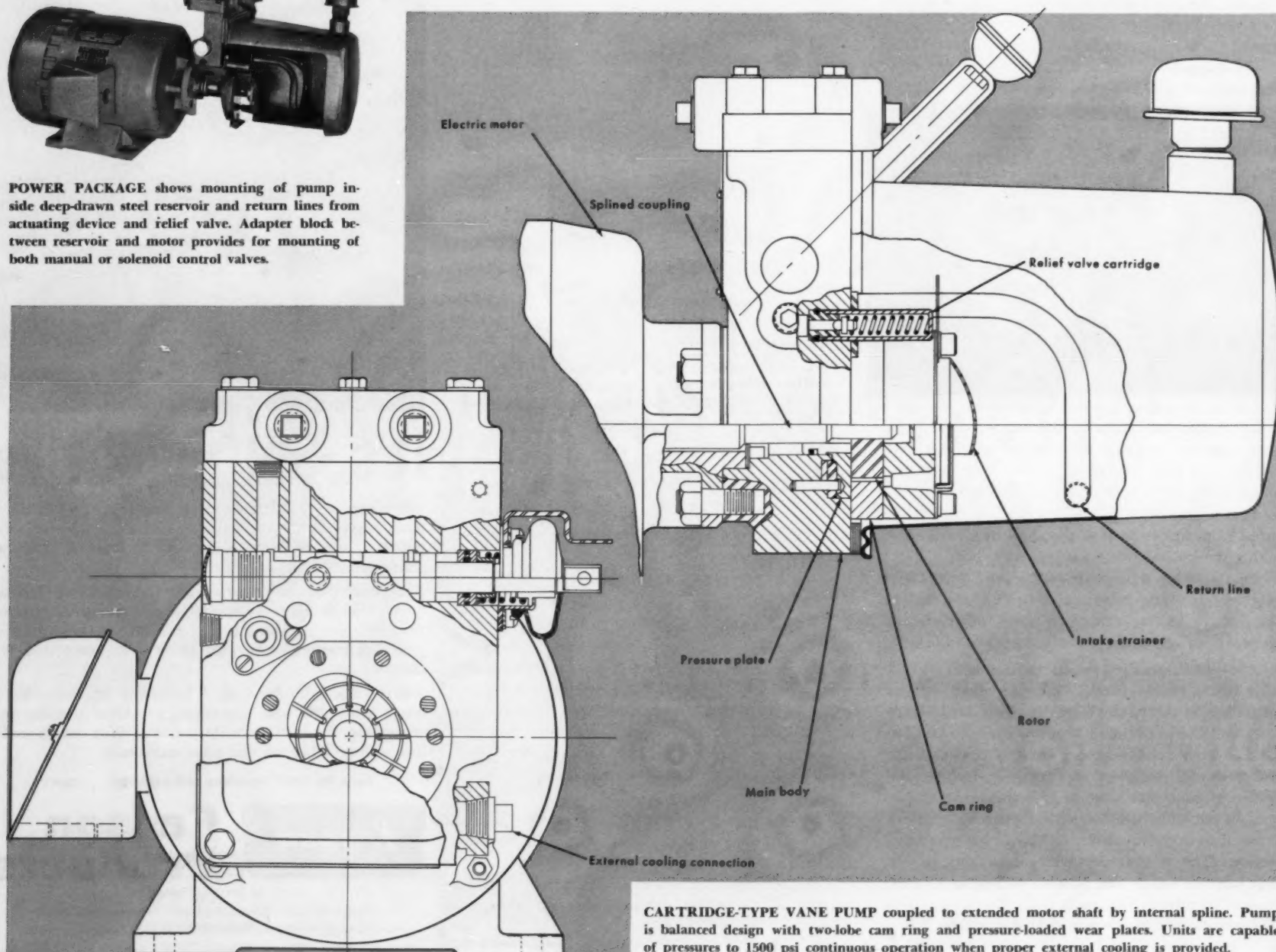
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## Extended Motor Shaft Eliminates Alignment Problems in Hydraulic Power Package

E. J. Stefanides, Central States Editor

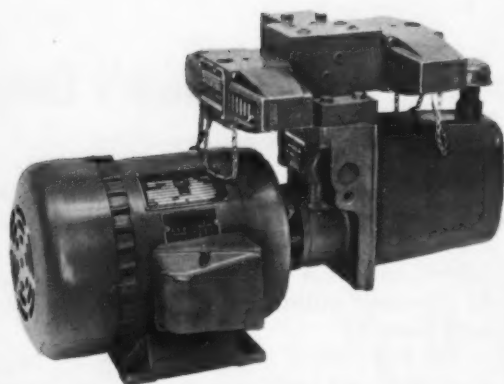


**POWER PACKAGE** shows mounting of pump inside deep-drawn steel reservoir and return lines from actuating device and relief valve. Adapter block between reservoir and motor provides for mounting of both manual or solenoid control valves.



**CARTRIDGE-TYPE VANE PUMP** coupled to extended motor shaft by internal spline. Pump is balanced design with two-lobe cam ring and pressure-loaded wear plates. Units are capable of pressures to 1500 psi continuous operation when proper external cooling is provided.





**PUMP** equipped with two solenoid valves. Motors are rated for 55C rise, have Class B insulation which allows 20 percent continuous overload without detrimental effects.

In a hydraulic power package, the pump rotor is mounted directly on the extended shaft of an electric drive motor. This design approach, using a special, splined extended-shaft motor, eliminates two pump bearings and the need for a flexible coupling. It also simplifies design by permitting all components of the power package to be mounted on the end of the motor. The end result is a package which meets the overall design objectives of simplicity, compactness and low cost.

The primary purpose in development of this line of equipment was to provide the user with a hydraulic power package which could be installed with a minimum of time and effort. All components except the actuating device can be installed by bolting down, making the electrical connections and attaching the supply and return lines for the actuating device. All mounting, alignment and piping problems associated with separate mounting of the motor, pump and control components are eliminated completely.

The control valves are mounted on a cast-steel adapter block located between the motor and the reservoir in which the pump is mounted. The adapter block has provisions for mounting up to three manually operated or two solenoid-operated directional valves. The adapter block also includes an adjustable relief valve for pressures up to 1500 psi and has provisions for connection of an external heat exchanger.

Intended for industrial applications, the unit is offered in three basic models with pump capacities from 1 to 8 gpm. It is designed and manufactured by the Machinery Hydraulics Div. of Vickers, Inc., Detroit, Mich., a division of the Sperry Rand Corp.



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## IDEAS...MECHANICAL

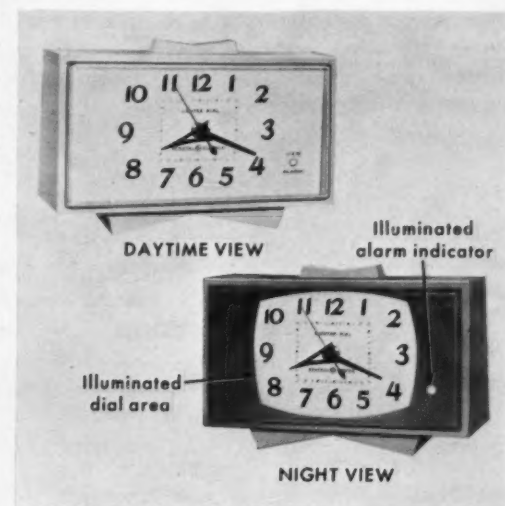
### Clock's Lever

Victor W. Wigotsky, Eastern Editor

A shutter operating in conjunction with a neon-lighted mask is adapted in an illuminated dial alarm clock. The simple mechanism provides a lighted indication of the setting of the alarm by effectively utilizing the clock's existing neon light-source.

The new feature is provided with few extra parts which are easily manufactured and assembled. The shutter is operated by a lever which is actuated by vertical movement of the clock's alarm-setting stud. A mask with a small hole outside the illuminated dial area provides the isolation of the spot of light from the illuminated clock face. The hole is located directly over the angle on the right edge of the clock's polystyrene lens. The lens angle then reflects light from the neon lamp forward through the hole in the mask to produce the desired bright spot. When the alarm shut-off lever is in "up" position, the light passes through a similar hole in the shutter, which then becomes concentric with the mask hole.

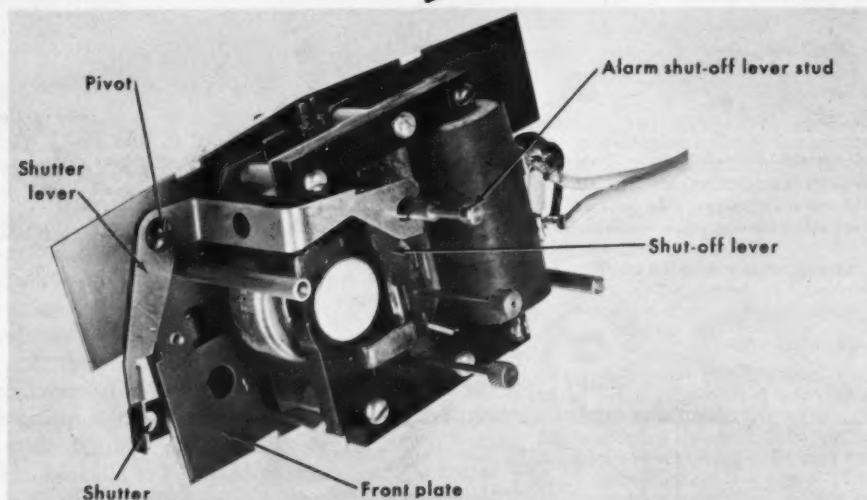
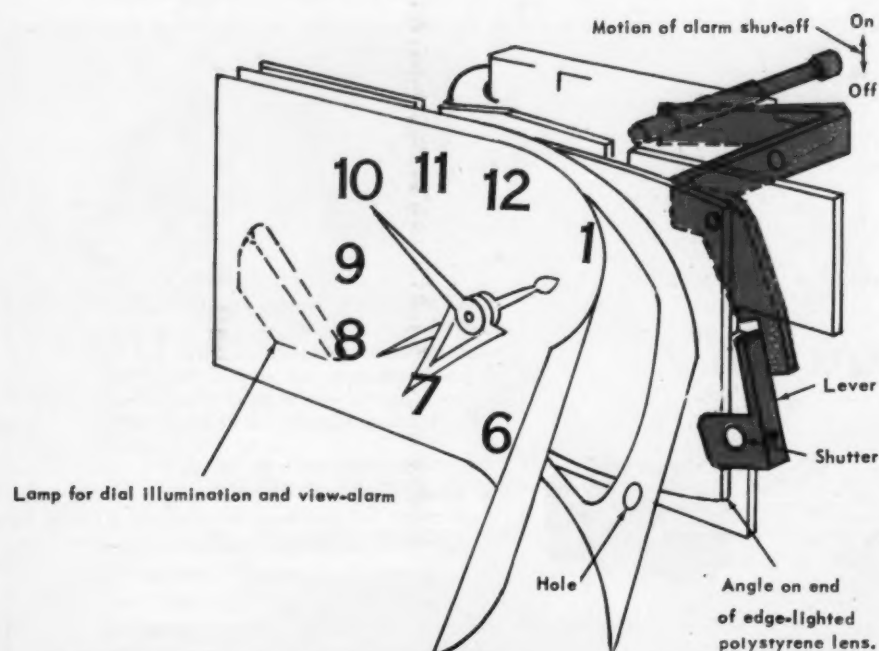
The Model 7270K Decor-ette alarm clock, incorporating the "View-Alarm", was designed by the Clock and Timer Dept., General Electric Co., Ashland, Mass.



DAYTIME and night views of illuminated dial. Shutter covers mask hole so that light cannot pass through when alarm shut-off stud is in "down" position. Hole in shutter permits light passage through mask hole when stud is moved to "up" position.



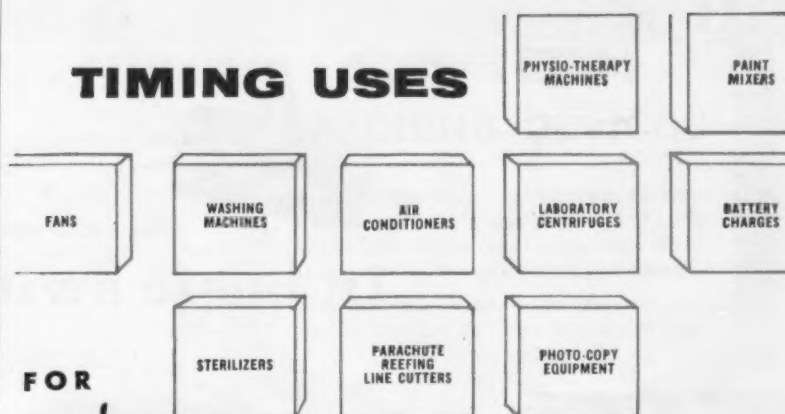
## and Mask Illuminate Alarm



MECHANISM is inexpensive, easily assembled and readily adapted to existing assembly techniques. Shutter and shutter lever are made in two pieces so that lever could be of heavy enough material to be rigid and shutter could be made of thin flexible metal to fit into small space between lens and mask under all tolerance conditions. Operation of shutter lever was originally complicated by buildup of tolerances from back of movement mounting plate to front

of polystyrene lens. Shutter lever is attached to front and pivoted on bushing and screw. Removal of screw then permits disassembly of lever and accessibility to motor. Small spot of light must be bright enough to be seen in contrast to large lighted dial area. This is achieved by use of mask with small hole outside illuminated dial area. Reflection of light from neon lamp, resulting from lens angle, produces desired bright spot through mask hole.

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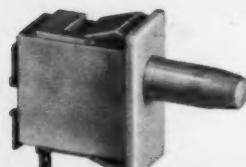


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**"PL"** — Designed especially for use on domestic appliances. Snap-on terminals for easy wiring. Single-pole single-throw or double-throw contact arrangements. Some single-pole single-throw are available.

**"7MP1"** — Enclosed mercury switch, unaffected by water or vapor and resistant to oil, alkalis and acids. Embedment material safeguards the switch from impact and provides seal at the lead entrance.

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**"AS408"** — Small size mercury switch offers space-savings and economy. For use on animated displays, freezer lids, floats, etc. Single-pole single-throw contact arrangement.

**"Z"** Series — Well suited for applications where a compact, reliable, precision switch is needed.

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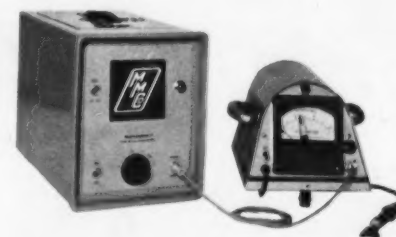
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## IDEAS...MECHANICAL

### Ball Bearing

E. J. Stefanides, Central States Editor



SYSTEM consists of amplifier, tracer head and traversing unit. Meter on traversing unit has built-in limit detector consisting of adjustable arms in front and behind needle on which photocell and grain-of-wheat light source are mounted. Interruption of light beam by needle actuates relay, energizing rejection signal light.

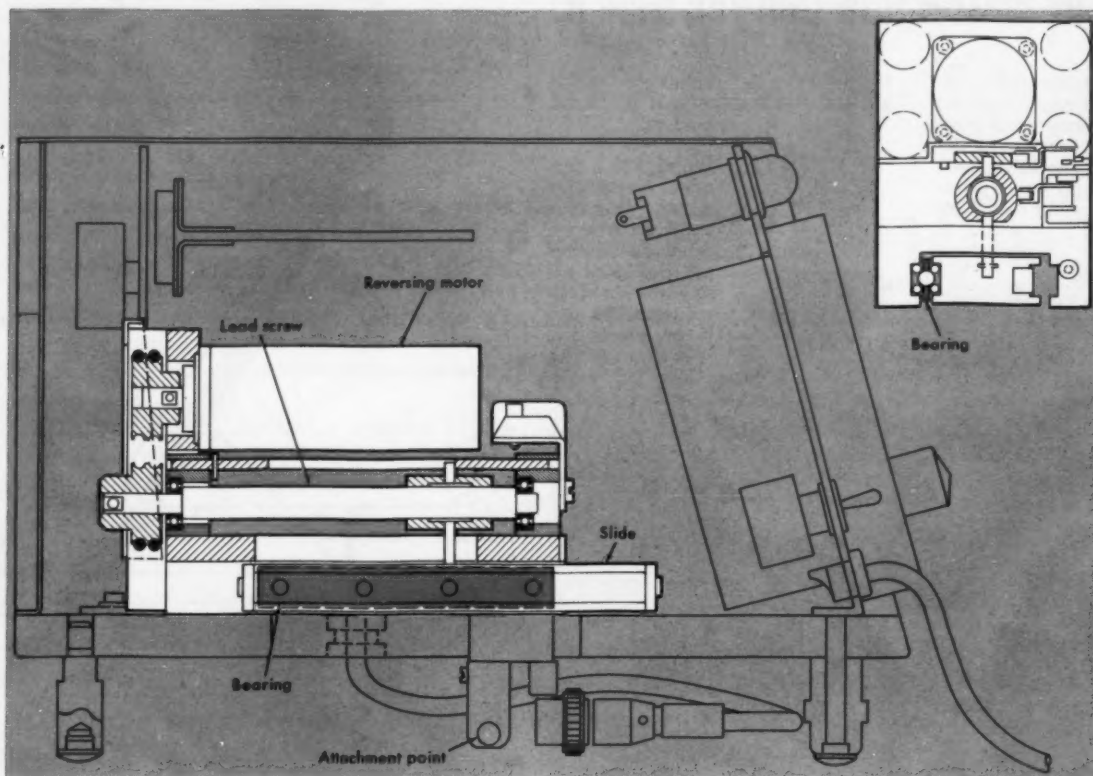
A simple, linear ball bearing is used in a new instrument for checking automobile finishes for orange peel effect (surface irregularities). The bearing provides a smooth, near-frictionless traverse of the slide on which the tracer head is mounted. Its design also minimizes lost motions which might impair the inherent high accuracy of the tracer.

Two bearings are used, one on each side of the slide. Each consists of a "Teflon" strip having four instrument balls located in holes along its length. The balls fit loosely in the holes and are held in place between four small-diameter wires which run along the top and bottom of grooves in the base and slide. These form the races for the balls. The slide's traverse is accomplished by a lead screw, belt-driven off a small electric motor.

In operation, the device is set down on the auto body and a manual switch is closed, starting the traverse motor. As the slide traverses, it carries a skid-mounted tracer with a pivoted movable stylus along the body. Vertical movements of the stylus move the coil of a transducer within the field of a permanent magnet. The electrical output signal is amplified by a separate amplifier and displayed on an electrical meter. The meter has a built-in limit-detecting device for triggering a rejection light. At ends of traverse, miniature limit switches automatically reverse electric motor.

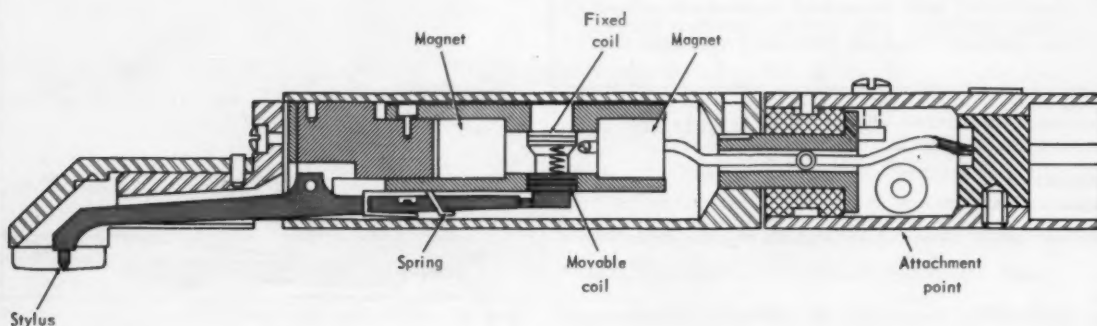
The instrument was designed and manufactured by the Micrometrical Mfg. Co., Ann Arbor, Mich.

## Provides Smooth Traverse for Tracer



VIEW OF TRAVERSING UNIT shows bearings (enlarged) on which slide travels. "Teflon" strip serves as spacer and is mounted loosely to base in space between grooves in slide and base. Actual bearing races are formed by two pairs of wires mounted on slide and base. Tracer is mounted on

pivots attached to slide. Spring forces tracer skids into contact with body to provide three-point suspension which allows checking of irregular surfaces. Miniature limit switches in traversing unit automatically reverse motor at ends of traverse.



TRACER STYLUS is lever mounted, actuates coil within permanent-magnet field. It has independent spring loading to maintain contact with body surface. Miniature limit switch in traversing unit cuts out amplifier circuit on initial stylus contact, protecting unit from surge.

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**No. 15642 Draw Pull Catch:**—Heavy-duty steel or brass construction in many finishes and varieties of strikes. Locking ears for padlock security. (No. 15642S available with single locking ear for padlocking.)

No. 15834



**No. 15834 Compression Spring Draw Pull Catch:**—Carbon steel with stainless steel spring cover and cradle. Flush mounting. Concealed springs. Many finishes. Approximately 60-lb. load at  $\frac{1}{8}$ " max. deflection. Withstands 600-lb. pull test. Meets military specifications.

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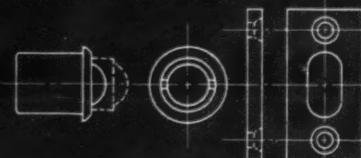
**No. 15804 Heavy-Duty Draw Pull Catch:**—Carbon steel with stainless steel connecting links. Approximately 100-lb. load at  $\frac{1}{8}$ " maximum deflection. Many strikes available.

**No. 15641 Draw Pull Catch:**—Heavy-duty, steel or brass construction, in many finishes. Variety of strikes available.

**No. 15250 Draw Pull Catch:**—Steel or brass construction, in many finishes. Locking ear for padlock security. Variety of strikes available.

\*Can be furnished with mounting holes, or without for spot welding.

Friction Catch that is ADJUSTABLE No. 3067



Projection and tension of ball are adjustable. All-brass, regularly furnished with carbon-steel ball (stainless steel ball also available). Phosphor-bronze spring. Can also be obtained with ROUND brass strike No. 2569.

These and many other items complete the extensive CCL line. Write for further information.



**CORBIN CABINET LOCK DIVISION**  
THE AMERICAN HARDWARE CORPORATION  
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# HOKE Flow Sheet <sup>7</sup>

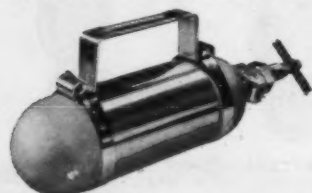
HOKE REPORTS ON FLUID CONTROL

## PRESSURE BY THE POUND...no matter how thin you slice it!

### Do You Have A Bomb In Your Lab?

In the process industry, sampling cylinders are occasionally referred to as bombs. In recent months, this misnomer has been, unhappily, pretty close to the truth. Some military surplus, low carbon steel, two-piece cylinders have found their way into industry and have been used beyond their rather limited capabilities. Unfortunately, several serious accidents have spotlighted this use as a very real safety problem.

Since sampling is such a serious business, we have perfected, for maximum safety, a seamless, one-piece cylinder. This unabashed declaration of excellence has sound

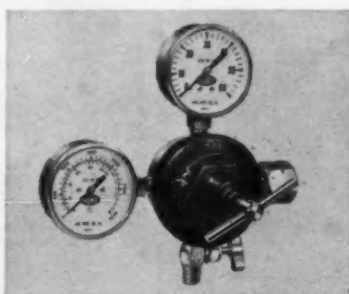


basis in fact — the entire cylinder is formed from a single piece of seamless type 304 stainless steel tube. To quell the qualms of process men, sample contamination is practically nonexistent, and the cylinder resists destruction from most corrosives.

As a further safety guarantee, all standard sampling cylinders are fabricated to meet ICC and other safety regulations. Standard cylinders are available at pressures to 1800 psi (10 ml. to 1 gallon), but higher pressure cylinders can be had on special order.

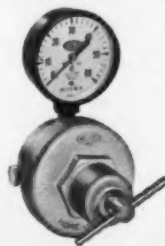
If you'd like additional information on Hoke cylinders, plus a detailed paper on the various methods of collecting samples from process lines, drop us a line. We'll also include details on special cylinder valves, outage tubes and other cylinder accessories.

One trouble with doing something better is that it's hard to stop. This time, we've come up with a new line of pressure regulators. We made them for the technically oriented who have developed high standards and for the penurious purchaser who wants something for (almost) nothing.



One, tagged as the 680 Series, is a highly stable single stage regulator with something for just about everyone. The core of this regulator is its control accuracy of 2% at flows to 2000 SCFH. Two models are available. One delivers 0 to 40 psi and the other 0 to 140 psi and both can handle inlet pressures up to 3000 psi. Use them on any gas compatible with 2024-T4 aluminum alloy, neoprene, polyurethane and Buna-N.

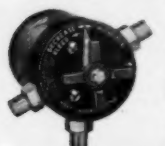
If what we've said sounds good so far, but still won't solve your problems, read on.



can be had by marking an "X" below.

We've built a regulator specially for corrosive gases and atmospheres. Available in either all monel or all stainless steel construction, we call it the 640 Series. Spec sheets on this

If you "X" the next box, you'll get a package of useful information on a special regulator that will handle delivery pressures up to 4500 psi with very high control accuracy. This is a 2 stage spring and dome loaded regulator and we claim that a 50% change in inlet pressure will not change the delivery pressure more than 2%. Operation is simplicity itself. For no particular reason, we call this the 920 Series.



Skeptics should send for all of this information.

### '61 PRODUCT PARADE

You'd be surprised at some of the screwball ways our valves have been used (to decided advantage, of course). Hoke distributors are armed to their maxillary third molars with this method madness and will re-design your systems with new Hoke products at the drop of a postcard. Check the PRODUCT PARADE Box.

#### Hoke's Performance Guarantee — Every Valve Leak-Tested!

HOKE INCORPORATED  
89 Piermont Road, Cresskill, N. J.

Send me complete information on the Hoke products checked below:

- ☐ 680 Series Regulator
- ☐ 640 Series Regulator
- ☐ 920 Series Regulator
- ☐ '61 Product Parade
- ☐ Sampling Cylinders
- ☐ Complete Catalog 6C561

NAME \_\_\_\_\_ TITLE \_\_\_\_\_  
COMPANY \_\_\_\_\_  
ADDRESS \_\_\_\_\_  
CITY \_\_\_\_\_ STATE \_\_\_\_\_

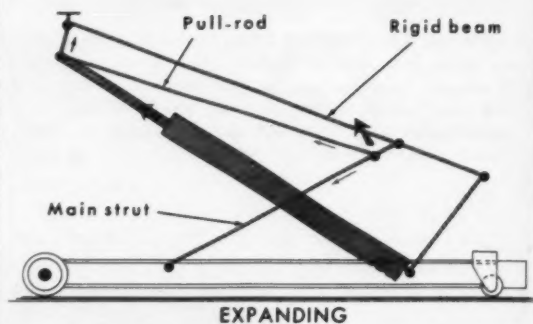
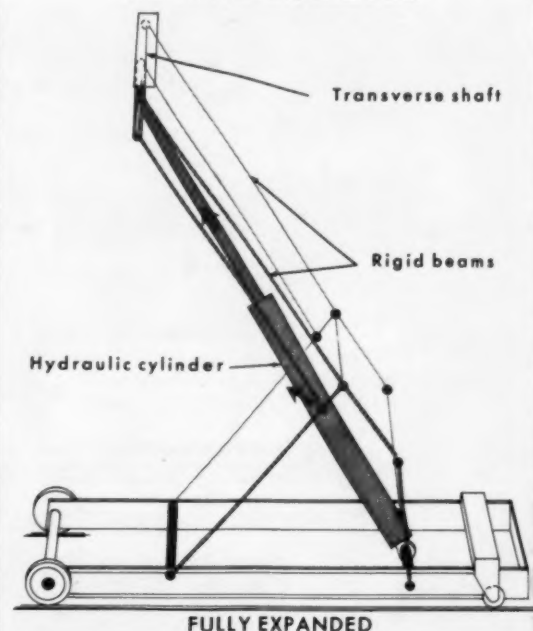
SEE OUR CATALOG IN SWEETS PRODUCT DESIGN FILE

Circle 13 on Reader-Service Card for more information

## IDEAS...MECHANICAL

### Double Parallelograms Boost

Celestino O. Lubatti, Italian Editor



MAIN STRUT forms adjacent sides of collapsible parallelograms. Power cylinder stretches out pull-rod, causing upward rotation of main strut and expansion of whole mechanism. Lifting power is produced by combined moments originated by cylinder and main strut.



# AVISUN

announces world's biggest  
polypropylene  
plant now in production

## Efficiency of Collapsible Hoist

Double parallelograms improve the mechanical advantage and extend lifting reach of a collapsible car hoist. The articulated structure folds down into a compact, flat carriage which is easy to handle for in-place repairs of trucks or other heavy equipment.

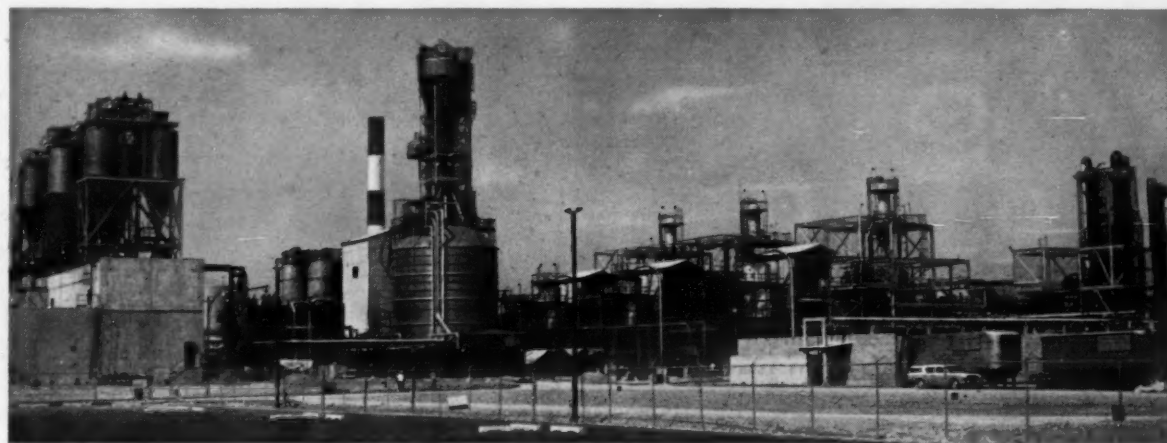
A hydraulic cylinder, powered by manual or motor-driven pump, connects the extreme corner of the upper parallelogram with the back corner of the base parallelogram. It produces a gradually rotating force which fully expands the mechanism with relatively short piston stroke. The articulated members develop a continuous lifting force, eliminating the dead points normally present in multiple-stage lifts of equal reach and power.

The base parallelogram is pivoted to the wheeled carriage; the upper one is attached to the main strut. A rigid beam forms the common top. Transverse shafts connect this system with an equal one, parallel to it, to form the heavy, three-dimensional structure.

The transportable hoist is produced by Fabbrica Italiana Sollevari F.I.S. Srl, Piasco, (Cuneo), Italy.



**HEAVY-DUTY CAR HOIST** develops 9000-kg (10 tons) lifting force, raises trucks, streetcars or buses for in-place repair or inspection. Collapsible structure permits 160-cm (5.25 ft) lifting height. Drip pan is laid over pull rods of upper parallelogram; these are narrowed to collapse within rigid beams.



100 million lb/yr capacity assures ample supplies of polypropylene for the fast-growing number of users

This giant new plant at New Castle, Del., establishes Avisun more firmly than ever as the industry's leading polypropylene supplier. It incorporates the most advanced manufacturing techniques—continuous processing—meticulous quality control—to produce polypropylene polymers of top quality and dependable uniformity. The polymers include a broad new range of impact grades, pipe grades and other specialty resins for fiber—and wrapping film in varying mil thicknesses.

From this great new facility will come the materials for strong, light, low-cost products of every description to meet the needs of home and industry.

And Avisun stands ready with technical assistance. Fully

equipped Customer Service laboratories—specialists with a broad and diversified background of experience in application problems—are at your service.

So plan now to explore the advantages of manufacturing or packaging with Avisun polypropylene. Complete technical data on Avisun polymer and film will be sent on request.

## AVISUN CORPORATION

Executive Offices

1345 Chestnut St., Philadelphia 7, Pa.

In Canada—Courtaulds Plastics Canada, Ltd.

•Trademark of AviSun Corp.



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Another First from AVISUN...

# OLEFORM\*



## a new, unusually low-cost thermoplastic now available for experimental testing...

**Featuring—Unusual toughness and rigidity • High heat resistance • Excellent chemical resistance • Low moisture absorption • Good electrical insulation qualities**

In rigidity and toughness Oleform compares favorably with thermosetting materials in many applications. And its improved creep resistance and mold shrinkage factors excel those of polyolefins. It can be injection molded satisfactorily, thus permitting faster mold cycles than for compression molded thermosetting materials. Its electrical insulation properties compare well with those of thermosets. And unlike thermosets, its molding scrap is reusable.

Oleform is available in a blue-gray molding grade in *experimental* quantities. AviSun technical specialists stand ready to assist you in any developmental work. For full details, fill in and mail coupon today.



AVISUN CORPORATION, Dept. 606  
1345 Chestnut St., Philadelphia 7, Pa.

I am interested in Oleform. Send full data available.

Name \_\_\_\_\_ Title \_\_\_\_\_

Company \_\_\_\_\_

Address \_\_\_\_\_

In Canada: Courtaulds Plastics Canada, Ltd.

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### COMPARISON

Properties	ASTM	Oleform	Acetal	Nylon 66	Wood Flour Filled Phenolic
<b>Mechanical<sup>a</sup></b>					
Tensile Yield Strength <sup>b</sup> , 10 <sup>4</sup> psi	D638	4.5	9.8	8.5-9	7.5
Elongation at Yield <sup>b</sup> , %	D638	6	10	60	1
Tensile Modulus, 10 <sup>4</sup> psi	D638	2.9	3.75	1.75	10
Flexural Modulus, 10 <sup>4</sup> psi	D790	5.5	4.1	1.75	10
Izod Impact Strength, ft-lb/in notch	D256	0.9	1.4	2.0	0.3
<b>Physical</b>					
Specific Gravity	D792	1.24	1.43	1.14	1.45
Heat Distortion Temp., °F at 66 psi	D648	295	338	360-390	300
at 264 psi		205	212	150-170	275
Water absorption (24 hr.), %	D570	0.02	0.12	1.5	0.6
Lin. Coef. of Ther. Exp., 10 <sup>-5</sup> in/in/°C	D696	3.8	8.1	10	3.8
<b>Chemical Resistance</b>					
Acids		Excellent	Attacked	Attacked	Good
Bases		Excellent	Attacked	Excellent	Attacked
Solvents		Good	Excellent	Good	Good
<b>COST</b>					
Cents/lb		36	65	98	22
Cents/cu in		1.5	3.3	4.0	1.2

<sup>a</sup> Injection molded specimens at room temperature

<sup>b</sup> Crosshead speed 1/min

<sup>c</sup> Crosshead speed 0.2/min

<sup>d</sup> Crosshead speed 0.05/min

### IDEAS...MECHANICAL

## Hypocycloid Gear Compacts

Ronald W. E. Martin, British Editor

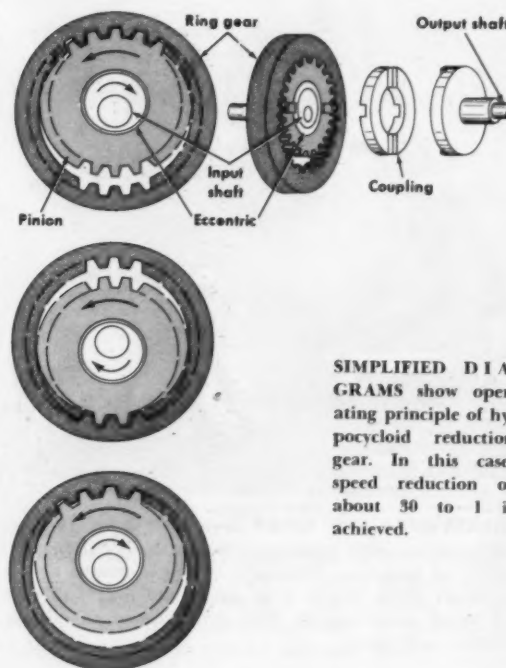
A hypocycloid-type gear (drive in which a small gear rolls around the inside of a larger one) is used as a compact speed-reduction unit in a hand-operated cradle winch. Input and output shafts are coaxial.

The gear consists of an internally toothed ring gear rigidly attached to the winch housing and a toothed pinion. The pinion is maintained in constant mesh with the ring by an eccentric integral with the input shaft.

Rotation of the input shaft and eccentric causes the pinion to roll around the ring gear, imparting a slow rotation to the pinion about its axis, opposite in direction to that of the shaft. This rotational movement is transferred to the winch output shaft by a simple coupling arrangement which eliminates the eccentric motion.

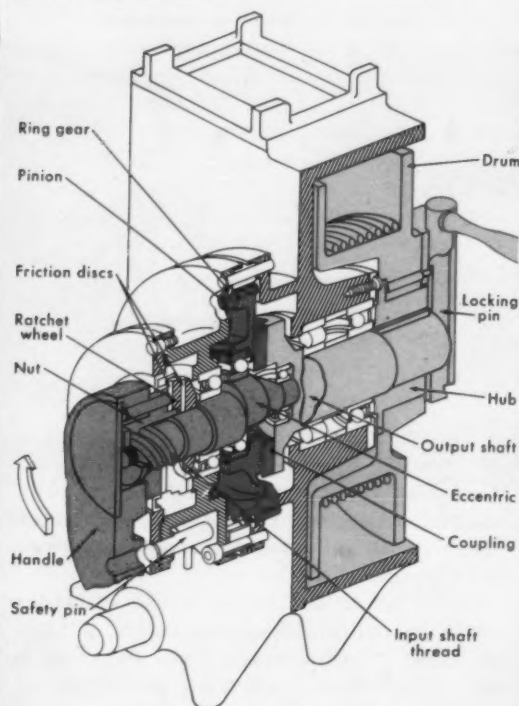
The winch also includes a self-acting, self-sustaining device which obviates the manual operation of levers and pawls. When the winding operation is completed, the device automatically locks and instantly sustains the load.

Reduction gear and self-sustaining device embodied in the cradle winch are a development of Varatio-Strateline Gears, Ltd., Slough, England.



**SIMPLIFIED DIAGRAMS** show operating principle of hypocycloid reduction gear. In this case, speed reduction of about 30 to 1 is achieved.

## Reduction Unit in Cradle Winch



**SELF-SUSTAINING MECHANISM** automatically locks load when either hoisting or lowering. Turning handle to raise load moves nut along thread of input shaft, sandwiching rotatable ratchet wheel between friction discs. When winding ceases, load tends to drive shaft in counter-clockwise direction, resulting in ratchet wheel engaging pawl. Although ratchet wheel is prevented from rotating, shaft tends to be driven by load. Nut moves axially and provides frictional lock. To lower load, handle and nut are turned in opposite direction. This action unlocks friction surfaces, permitting rotation of complete drive assembly except ratchet wheel. When lowering ceases, torque created by out-of-balance effect of handle causes nut to move forward, locking drive and thus sustaining load.



# LOOK-ALIKES...BUT NOT ACT-ALIKES

## AVISUN announces four new impact grades of polypropylene

Here, for the first time, are new impact grades of polypropylene—all possessing a translucent white resin color—with flow rates suitable not only for injection molding, but also for sheet extrusion, vacuum forming and blow molding. All four retain desirable properties characteristic of general purpose polypropylene—lightness, low cost, high heat and chemical resistance. *But each grade offers a step-up in impact strength at room temperatures. Equally important, most of this strength is retained at lower temperatures—in the case of High Impact Grade 3210, as low as 10°F.*

AviSun technical specialists can help if you plan to use a new AviSun impact grade of polypropylene for your product. For full technical data or counsel, write to us.

### SPECIAL PROPERTIES

Property	Impact Grade 3116	Impact Grade 3216	High Impact Grade 3211	High Impact Grade 3210
Izod Impact Notched—ft-lb/in Unnotched	1.5 over 16	2.0 over 16	10 over 16	15 over 16
Flow rate—gm/10 min (nominal)	5.0	5.0	0.7	0.5
Type of molding	injection	injection	sheet extrusion vacuum forming	blow

### AVISUN CORPORATION

Dept. 604

1345 Chestnut St.

Philadelphia 7, Pa.

In Canada: Courtaulds Plastics Canada, Ltd.

\*Trademark of AviSun Corp.



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# AVISUN announces new polypropylene 1051 pipe grade resin

● Easy fabrication ● Easy welding and joining ● Light weight ● Low cost ● High heat resistance ● High chemical resistance ● Low friction loss ● Approved for potable water use by National Sanitation Foundation

In an important advance stemming from extensive research, AviSun introduces the first high molecular weight polypropylene pipe grade resin combining low cost with excellent properties. It has been broadly tested with highly satisfactory results. AviSun pipe grade resin can be processed in most conventional plastic extruders—at rates equal to or greater than that of linear polyethylene. Its high per-pound yield makes it one of the most economical plastics.

Because of the attractive properties, pipe from this resin should yield optimum performance in such applications as: salt water disposal lines; gas gathering and distribution systems; crude oil flow lines; conduit; municipal

water systems; process lines for organic and inorganic chemicals; automotive and aircraft tubing, and many others. For more data on AviSun polypropylene 1051 pipe grade resin, fill in coupon.



\*Trade mark of AviSun Corp.

AviSun Corporation, Dept. 605  
1345 Chestnut St., Philadelphia, Pa.

Send me complete data on new 1051 pipe grade resin.

Name \_\_\_\_\_ Title \_\_\_\_\_

Company \_\_\_\_\_

Address \_\_\_\_\_

In Canada: Courtaulds Plastics Canada, Ltd.

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## IDEAS...MECHANICAL

### Draw Plate Holds Tool

Edward W. Schrader, Western Editor

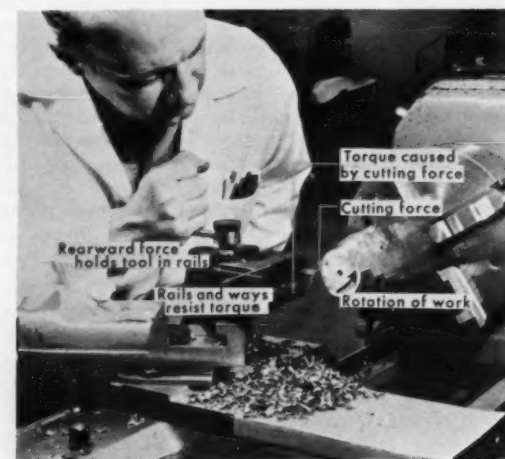
In a quick-change tool holder, the rearward action of a draw plate clamps the tool adapter in half-round rails to resist the torque induced by high cutting forces. A tapered shaft, acting as a cam, moves the draw plate to the rear as the shaft threads into the base of the tool holder. Twenty lb of force on the locking handle exert a pull of 15,000 lb force on the draw plate.

An optional, air-operated locking system which can be attached to the tool holder increases convenience of the quick-change holder still further. Manipulation of an air valve lever automatically tightens or loosens the draw plate.

The base, drop-forged from 1040 steel and heat-treated, contains a dual set of rails which mate positively with the ways on the tool adapters. The action of the draw plate engages the adapters with uniform force to resist movement and vibration.

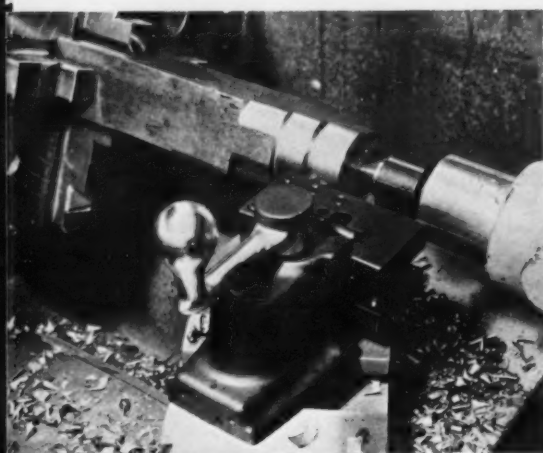
Center height adjustment of the adapters is controlled individually by adjustable, self-locking screws in each adapter. These set screws locate against a fixed position stop pin in the base.

The tool holder is a design development of Manco Tool Co., Inc., Burbank, Calif.

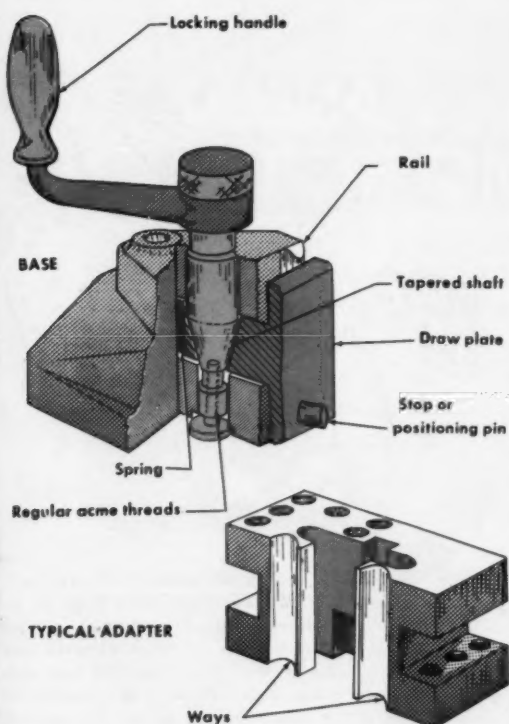


**LOCKING FORCE** on draw plate holds adapter against tool holder. Rails and ways resist torque created by cutting force as work rotates against tool. Friction in acme threads resists loosening of operator's handle by machine vibration. In simple test of rigidity, parting tool cuts high-ductility steel, 4340, with heavy feed. When tool is withdrawn from cut, there is no spring-back; no spiral tool marks on sides of cut are evident.

## Rigid against Round Ways



TOOL HOLDER permits quick change of adapter to suit each machining operation.



TAPERED SHAFT rotates when operator turns handle. Acme threads pull shaft downward to cam draw plate against spring. Action clamps adapter between draw plate and half-round rails.

*Flex it a million times...an*



Speaker vents spaced 0.020", molded-in snaps, and thin-section self-hinge on battery door show the molding versatility of AviSun injection grade polypropylene. Custom molded for Motorola by Sinko Manufacturing and Tool Co., Chicago 31, Illinois.

## AVISUN polypropylene self-hinge *won't break!*

Motorola chose AviSun polypropylene for the cases of their transistor radios for these good reasons:

**UNIQUE FLEXIBILITY.** Self-hinge characteristic is new in the plastics field... can be used to cut costs, speed assembly, improve designs on a wide range of cases, boxes, and receptacles.

**HEAT RESISTANCE.** Polypropylene will not soften or lose strength, even at temperatures close to 220°F.

**TOUGHNESS.** Has the resiliency to absorb dropping and rough handling without chipping, cracking, or breaking.

**ECONOMY.** Polypropylene, lightest of all plastics, gives high yield per pound. Takes texture, detail and speaker vents beautifully.

The same advantages that make polypropylene the choice for transistor radio cases can benefit you in your product. Call on AviSun for complete data on resin grades—and for expert technical assistance.



Mail coupon for technical information

AVISUN CORPORATION  
Dept. 591, 1345 Chestnut St.  
Philadelphia 7, Pa.

Send me Booklet AP-601 giving full technical information on AviSun Polypropylene.

NAME \_\_\_\_\_  
(Please Print)

COMPANY \_\_\_\_\_

ADDRESS \_\_\_\_\_

CITY \_\_\_\_\_ STATE \_\_\_\_\_

In Canada: Courtaulds Plastics Canada, Ltd.

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# TORRINGTON



## WHY DESIGNERS DO A "DOUBLE-TAKE" ON TORRINGTON SELF-ALIGNING BALL BUSHINGS

This Self-aligning Ball Bushing is designed for tough work...takes misalignment in its stride while supporting the heaviest radial, thrust or combined loads. Even low frequency oscillating operation can be accommodated.

Self-aligning ball bushings, so simple and inexpensive, are often overlooked. Take a look at Torrington's for the best solution to many misalignment and heavy loading problems.

Both the ball (inner ring) and the mating, spherically ground outer ring, are made from bearing quality steel. The outer ring has a cylindrical O.D. to permit normal mounting. Oil holes and grooves permit relubrication through either shaft or housing.

You'll find the Torrington Self-Aligning Ball Bushing is the most effective answer to tough, heavy-duty problems. For details, call or write us today.

### TORRINGTON SELF-ALIGNING BALL BUSHINGS

#### Series SBB (for industrial applications)

All surfaces phosphate coated and treated with dry film molybdenum disulphide lubricant.

*progress through precision*

**TORRINGTON BEARINGS**

**THE TORRINGTON COMPANY**

South Bend 21, Indiana • Torrington, Conn.

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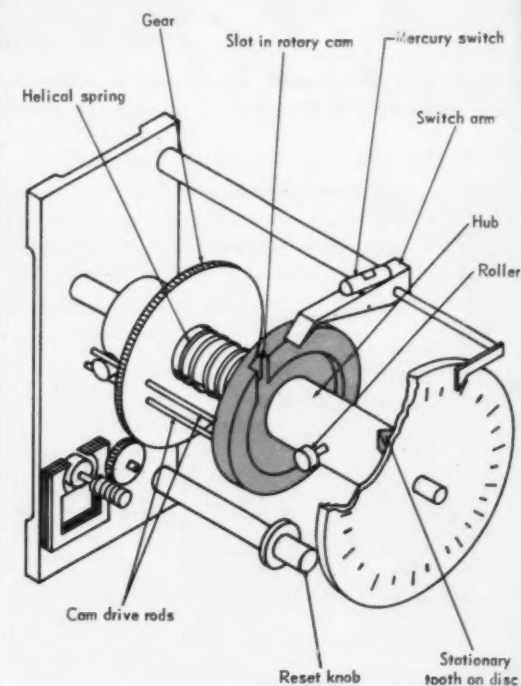
## IDEAS...MECHANICAL

### Axial Displacement of Cam

G. B. Bernard, Correspondent in France

A slotted, rotating circular cam is displaced axially by a stationary tooth on a disc to move a timer's switch arm. Speed of the synchronous-motor-driven slotted cam determines the timer period. Angular position of the single tooth on the disc sets the on/off ratio within this period. Continuous resetting is possible by turning the tooth and disc without stopping the timer. No motor-driven parts are used for the adjustment.

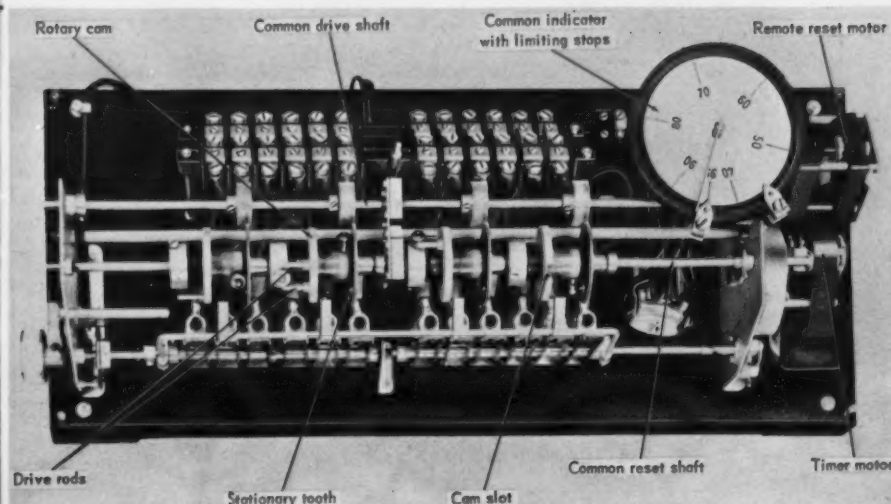
The "Graduator" timer is the product of Alkan & Sinay, Paris, France.



**REDUCTION GEAR**, slotted cam and disc carrying tooth are mounted coaxially on fixed timer shaft. Drive to rotating cam is through two rods. Pivoted arm carrying mercury switch normally rides on periphery of main cam. In this position switch is "on". Rotary cam has hub with small roller on radial shaft. When roller encounters tooth on disc, rotary cam is pushed toward gear against pressure of helical spring. Switch arm loses contact with rotary cam and drops down beside it, turning switch "off". Arm stays down until slot in rotary cam comes around, permitting spring to restore rotary cam to initial position. Slot engages arm and returns it to periphery of rotary cam.



## Moves Timer's Switch Arm



COMPOUND TIMER uses four units in differing phases.

## SENSITIVITY UNEQUALED with **IP** TORQMETERS



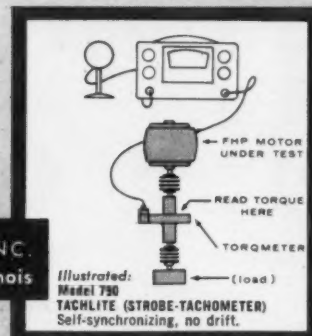
For ACCURATELY MEASURING Rotating and Static TORQUES of FHP motors, gear-train efficiencies, ball bearings, servos, synchros, potentiometers, hair springs, and many other applications and devices.

We invite your inquiry for complete information and prices... or, send your specifications and application needs.

Illustrated:  
**Model 783 OZ-TORQMETER**  
measures from .05 to 80 oz.—inch  
Also available:  
**Model 782 GRAM-TORQMETER**  
measures from .25 gm-cm to 100 gm-cm  
**Model 784 POUND-TORQMETER**  
measures up to 200 lb.—inch  
**Model 781 GRAM-TORQMETER**  
measures from .05 gm-cm to 5 gm-cm

**POWER INSTRUMENTS, INC.**  
7352 North Lawndale Ave. • Skokie, Illinois

NOTE: A few choice territories available for experienced representation.

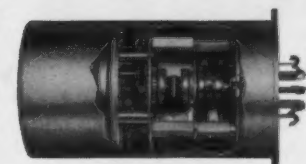


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## split second timing

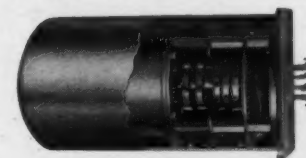
in Your  
**Aero-Space  
Circuits**

## demands **EAGLE** Mil-Spec **MOTOR DRIVEN TIMERS**



"AR" SERIES RESET TIMER

Following predetermined time cycle, motor stops. When clutch is released, timer resets to starting position within 150 milliseconds.



"AR" SERIES PROGRAM TIMER

Unit repeats predetermined cycle continuously until power to the motor is interrupted.

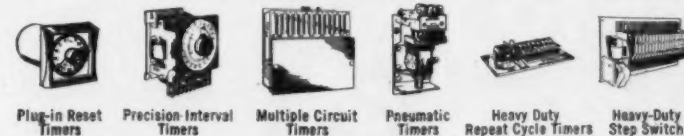
Here's a PERFECT PAIR of miniature, hermetically sealed motor driven timers for both airborne and ground support applications. Operative in 12 G acceleration, these versatile units perform reliably in extremes of vibration and temperature.

### SPECIFICATIONS

- COMPACT—2 1/4 x 4 1/2" outside cylinder dimensions • LIGHT WEIGHT—30 oz. or less • UP TO 7 independent load circuits • TIME CYCLES—1 second to several hours • POWER INPUT—Choice of 115 V., 60 cycle; 115 V., 400 cycle; 28 V.D.C. • FLEXIBLE—Can be equipped with plug-in header for quick change of time cycles

Write for Bulletins 825 and 830 or call your local Eagle Representative. He's listed in Sweet's Product Design File, Section 7d, or in Thomas Register.

TIMERS ALSO CUSTOM-BUILT TO MIL-SPECS. COMPLETE FACILITIES FOR QUALIFICATION TESTING.



MANUFACTURERS OF THE MOST COMPLETE LINE OF GROUND SUPPORT TIME CONTROLS.



**EAGLE SIGNAL COMPANY • Moline, Illinois**  
INDUSTRIAL DIVISION

DIVISION OF THE GAMEWELL COMPANY, AN E. W. BLISS COMPANY SUBSIDIARY  
Circle 21 on Reader-Service Card for more information

# OHIO RUBBER

"CUSTOMEERED COMPONENTS BASIC TO INDUSTRY"



## STAINLESS STEEL JEWELS make facsimiles by the million!

**OHIO RUBBER** can, and regularly does produce 100,000 *identical* rubber parts per day from one set of production tooling. The jewel-like precision of the self registering molds shown above—actual size—is a key factor in ORCO's high speed, high accuracy, continuous molding process.

**AUTOMATIC INTEGRATION** of processing steps which are usually handled

separately eliminates variables—provides precise control for achieving the ultimate in product uniformity. RUBBER PARTS up to 1½" in diameter and 1" in thickness produced by this process are distinguished by uniformity, minimum flash and precision tolerance of  $\pm .003$ ".

**QUANTITY REQUIREMENTS** involving not less than 500,000 parts proves

best for this new process.

"DO YOU use small precision molded rubber parts by the million?", if so, the full story of ORCO "CUSTOMEERED" Continuous Molding is yours via free Bulletin CM-100. Send for your copy today to see how custom molded, precision rubber parts can be produced in volume—at less cost.

MP-160



**THE OHIO RUBBER COMPANY**

General Office • **WILLOUGHBY, OHIO** • Whitehall 2-0500

A DIVISION OF THE EAGLE PITCHER COMPANY

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## IDEAS...MECHANICAL

### Double-Ended Screws Tighten Locking Bars on Coke-Oven Doors

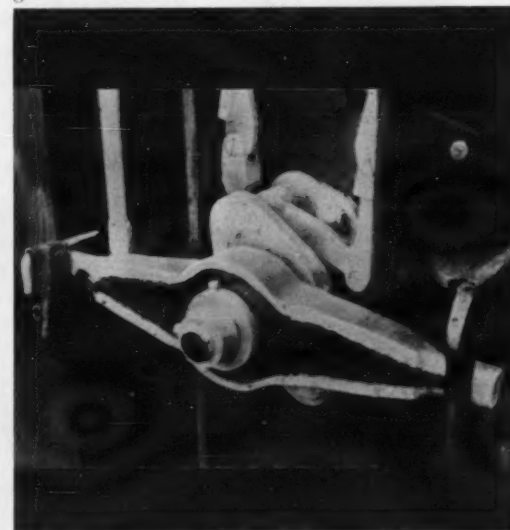
Roland Maqua, Correspondent in Belgium

Locking and unlocking forces for a heavy bar are reduced by twin double-ended screws, providing axial clearance between two hooks and the bar before it rotates. The system makes it possible to secure massive coke-oven doors, which must seal tightly, by a relatively light pull on the connecting rods.

High-pitch right- and left-handed threads at each end of the screws produce large axial displacement of movable nuts on one end, when screws are turned through small angle. Translation is doubled by having other screw ends turn in nuts fixed to the door. Moving nuts are anchored to a flanged sleeve carrying the bar, so that bar and nuts are displaced together.

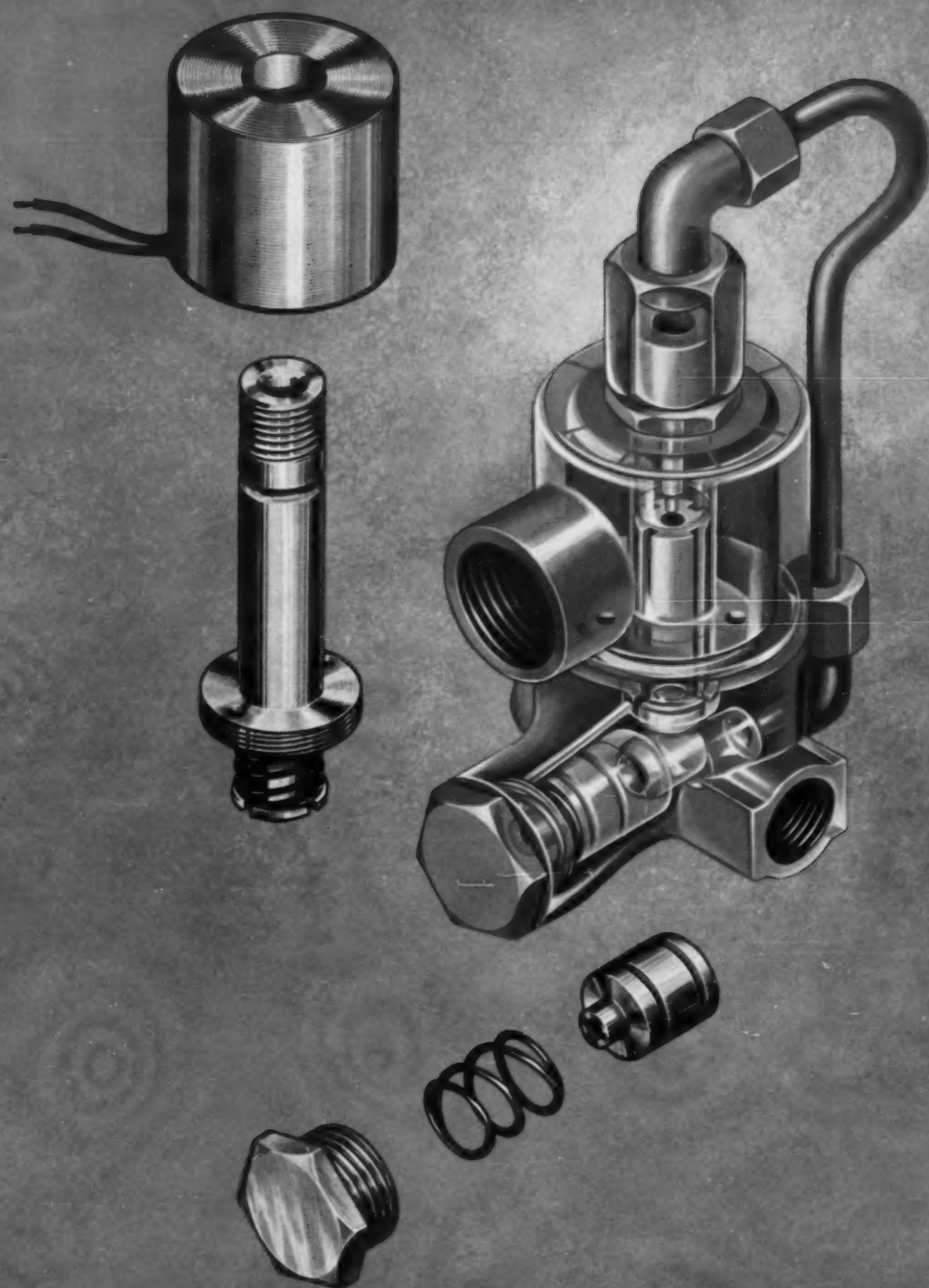
A stack of Belleville washers is compressed by the inward motion of the nuts preceding bar rotation and unlocking; during locking, procedure is reversed. Bar then swings into place before washers expand to push bar against its hooks.

Actuating screws are rotated by radial levers tied to the operating rods. Adjustable lugs on the rods rotate the bar with the proper delay, and keep the mechanism simple. According to Societe d'Etudes et de Construction Evence Coppee, S.A., Brussels, Belgium, trials equaling several years of normal operation have produced negligible wear.



Circle 23 on Reader-Service Card



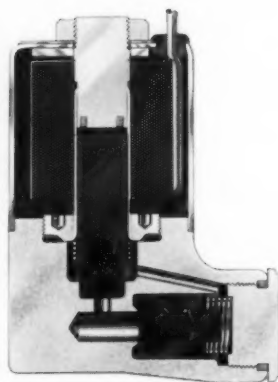


**SKINNER** 2-way Solenoid Valves  
for high flow, high pressure applications



# Here's how Skinner two-way valve design provides long lasting, trouble-free operation

- Underwriters' Laboratories approved
- Stainless steel internal parts resist corrosion
- Forged naval brass body
- Famous Skinner V5 solenoid operator
- Well rounded main orifice and pilot seats



NORMALLY CLOSED TYPE R2

When you have high-flow control problems at standard or high pressures the new Skinner two-way R series valves may be the answer. These pilot-operated solenoid valves are designed for use with air, oil, water, inert gases and other common media at operating pressure differentials of 5 up to 1250 PSI. They may be used for all types of control applications, such as: in high-pressure lifting, commercial laundry equipment, machinery, machine tooling, spraying, etc.

Skinner R series two-way valves have forged naval brass bodies to provide a dense metal structure and use a foolproof stainless steel piston with soft synthetic insert to open and seal the main orifice. Types are available normally open or normally closed,

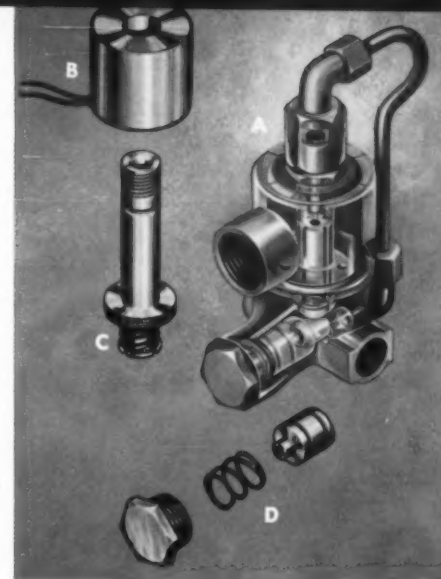
in standard and explosion-proof construction.

To make installation easy for every application, a wide choice of electrical housing options is available. These include JIC, AN connector, automotive terminals, etc. All housings can be rotated 360°. Manual override is also offered to permit manual opening of normally closed valves, or closing of normally open valves, in emergency.

Skinner R series valves may be used with all common voltages and frequencies and there are several coil types such as: varnished, molded waterproof, tropicalized and high temperature for specific applications.

The R series, illustrated here, is just one in a complete range of 2-, 3- and 4-way Skinner solenoid valves.

- A—Transparent view of normally open 2-way R type valve with piped pilot exhaust return  
B—Coil C—Sleeve, plunger and spring assembly  
D—Piston assembly with soft synthetic insert



## TWO-WAY R SERIES SPECIFICATIONS

Types	R2 XR2	R2H XR2H	R2H6	RP1 XRP1
Position	Normally closed	Normally closed	Normally closed	Normally open
Pipe Size (NPTF Dry Seal)	1/4"	1/4"	1/4"	1/4"
Orifice Size	1/4"	1/4"	1/4"	1/4"
Cv Factor	.758	.758	.758	.758
Operating Pressure Differential (PSI)				
Minimum	5	5	5	5
Maximum AC Service	200	1250	—	150
Maximum DC Service	200	500	1000	150
Leakage	Bubbletight	Bubbletight	Bubbletight	Bubbletight
Temperature Range (Ambient and Media)	Minus 40°F to plus 180°F	Minus 40°F to plus 180°F	Minus 40°F to plus 180°F	Minus 40°F to plus 180°F

When you specify solenoid valves, specify Skinner.

Skinner solenoid valves are distributed nationally.

For complete information, contact a Skinner Distributor listed in the Yellow Pages or write us at the address below.



# SKINNER ELECTRIC VALVES

SKINNER ELECTRIC VALVE DIVISION  
THE CREST OF QUALITY SKINNER PRECISION INDUSTRIES, INC. • NEW BRITAIN, CONNECTICUT, U.S.A.

PRINTED IN U.S.A.

# How to select or design a pump for pressure lubrication

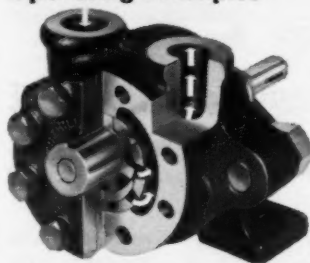
by E. H. Schanzlin

Chief Engineer, Tuthill Pump Company

Our headline is something of a misnomer . . . for designing a pump for pressure lubrication today would be as pointless as designing a dowel pin.

Instead, there's a simple and increasingly popular answer to this problem. Practically every important manufacturer of air conditioning or large air compressors . . . manufacturers of machine tools . . . diesel engines . . . plus hundreds of manufacturers of diversified industrial equipment from valve operators to giant gear boxes . . . have selected Tuthill internal gear pumps for this demanding application because of compact size, economical price, quiet operation . . . and, above all, for their dependability, proven in over thirty years of operation.

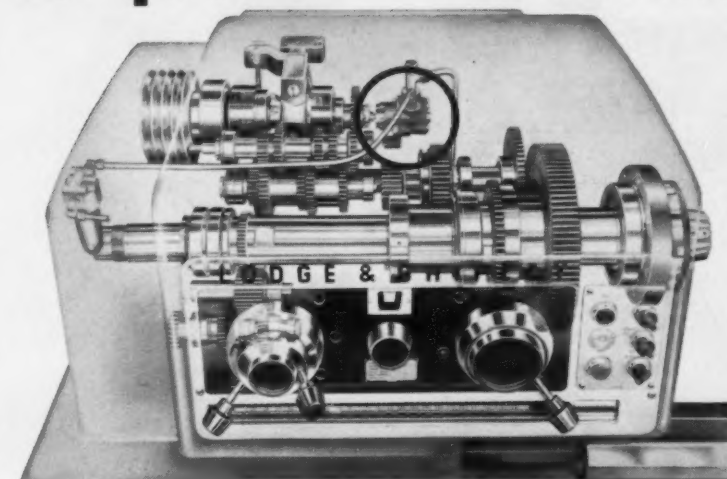
## Internal Gear Operating Principles



Tuthill internal gear pumps have only two moving parts. The pumping principle is based on the use of a rotor, idler gear, and a crescent shaped partition cast integral with the cover.

Power applied to the rotor is transmitted to the idler gear with which it meshes. The space between the outside diameter of the idler and the inside diameter of the rotor is sealed by the crescent.

As the pump starts, the teeth come out of mesh increasing the volume. This creates a vacuum, drawing the liquid into the pump through the suction port. The liquid fills the



*Tuthill model ORL pump provides pressure lubrication for Lodge & Shipley POWERTURN lathes. Mounted in headstock area, this reversing pump is driven by a reversing clutch shaft, provides positive reversing action. Ports remain constant without use of valves.*

spaces between the teeth of the idler and the rotor, and is carried past the crescent partition to the pressure side of the pump. When the teeth mesh on the pressure side, the liquid is forced from the spaces and out through the discharge port.

## Special Advantages of Reversing Pumps

Tuthill also offers a complete selection (375 models) of internal gear pumps with a special reversing feature. The unique construction of these units permits positive reversing action without the use of valves, and with the port positions remaining constant.

Reversing pumps are necessary when the lubrication pump must be driven by a reversing shaft, or when machinery must be shipped without knowing the ultimate direction of the driving unit.

A good example is shown above. A reversing pump is mounted directly on the reversing clutch shaft in the headstock area of Lodge & Shipley's POWERTURN lathes to provide dependable pressure lubri-

cation of these outstanding machine tools.

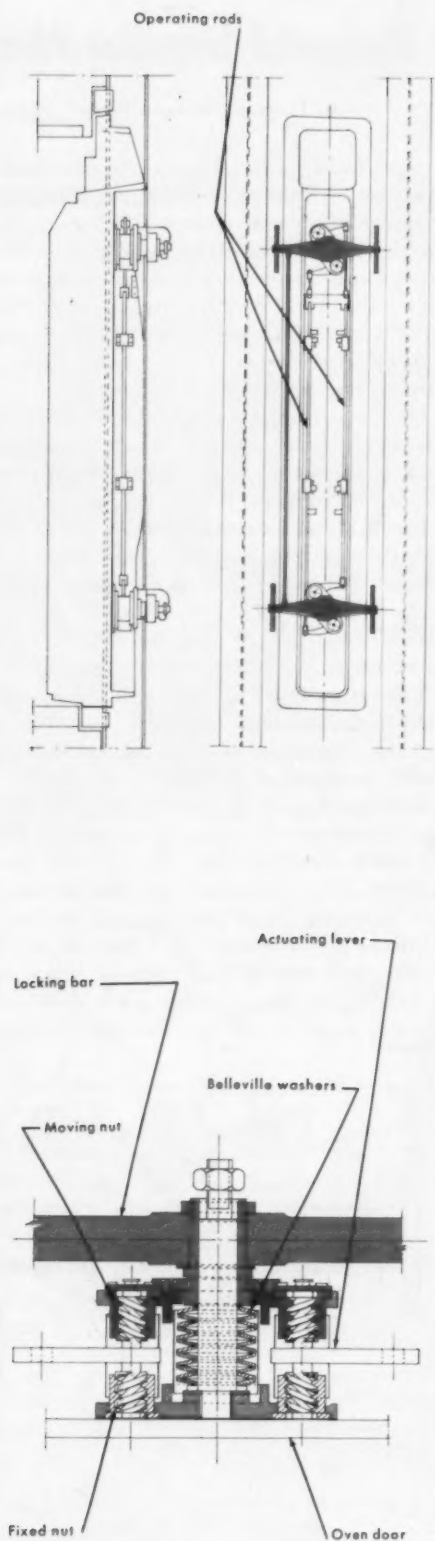
## Stripped or Cartridge Models

For extremely crowded applications, or extra economy, Tuthill also offers a complete selection of stripped and cartridge models, in which only the basic pumping elements are supplied for incorporation directly into your equipment. These units have been widely used to supply positive pressure lubrication and hydraulic power in many important applications.

## Over 800 Models

Tuthill's complete selection of internal gear pumps includes over 800 different models from stock for capacities from 1/4 to 200 gpm; for pressures to 500 psi; and speeds to 3600 rpm. Specially designed housings, shaft extensions, relief valves and many other features can be developed by Tuthill engineers for specific applications.

Write for complete catalogue No. 100 . . . or send us drawings on your application so Tuthill's engineers can make specific suggestions.



*Tuthill manufactures a complete line of positive displacement rotary pumps in capacities from 1/3 to 200 gpm; for pressures to 1500 psi; speeds to 3600 rpm.*



**TUTHILL PUMP COMPANY**

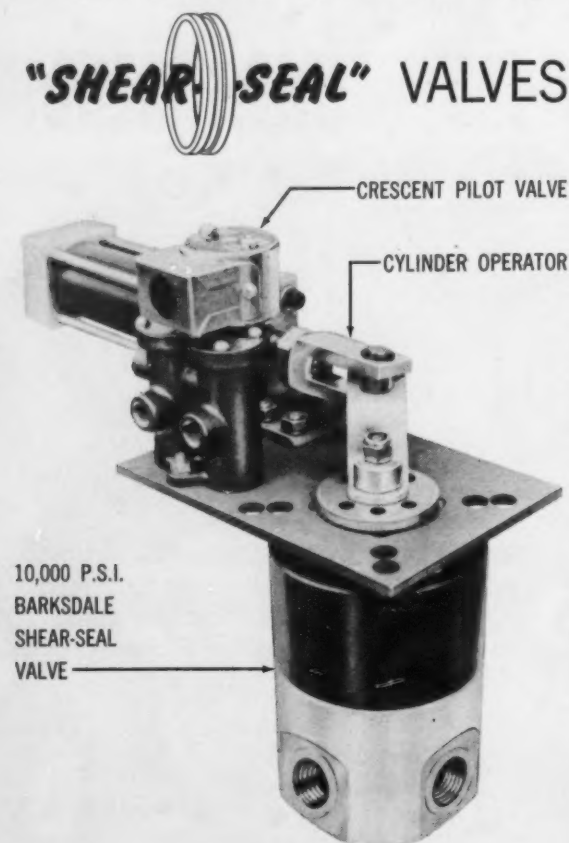
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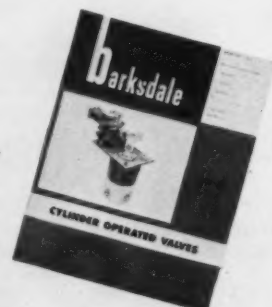
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4-Way, 3-Way and Shut-off valves range in pipe sizes from 1/4" to 1 1/2" N.P.T

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None of the operating advantages of this rugged 'Shear-Seal' valve has been reduced one iota!



- ... same non-corrosive construction throughout — eliminates failures due to rust.
- ... same long wearing leak-proof qualities — metal to metal 'Shear-Seal' design is not sensitive to dirt, compensates for wear.
- ... same installation savings — because no oilers or filters are needed.

Only the exterior has been modified — tailored to the special preference of the Original Equipment Manufacturers — and, as a result, costs and prices have been substantially reduced.

Write for bulletin 5000 which includes design specs.



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## IDEAS...MECHANICAL

### Recessed Impeller Moves

R. F. Stengel, German Editor

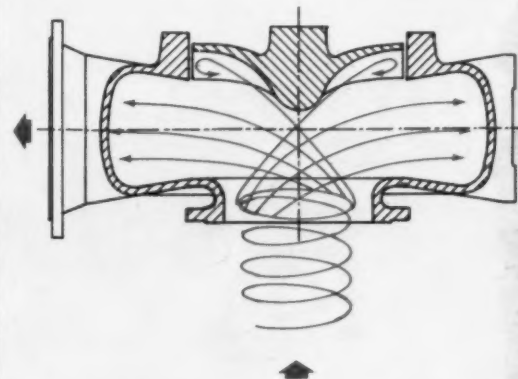
A centrifugal pump has a recessed impeller which moves fluid by indirect momentum transfer instead of driving it directly. The impeller is placed opposite the axial intake; rotation of blades causes vortex flow with centrifugal forces driving the liquid peripherally toward the radial outlet. Major advantage over conventional pumps is unrestricted flow for highly viscous fluids, suspensions and entrained solid material.

The recessed impeller is relatively small, which cuts down direct friction between blades and fluid. In the main stream, liquid flow is continuous instead of being "chopped" by the passage of blades. The cavitation limit is also higher. A peculiarity of the flow pattern is that the flow velocity within the housing is less than in the intake and outlet ducts. Pressure rise sets in upstream of the pump, since the hydraulically induced vortex reaches into the intake duct.

The rather low axial thrust is partly compensated by shallow blades on the reverse side of the impeller. Hydraulic and dynamic imbalance are absent; overhang of impeller is kept short.

The liquid space is sealed by a novel bellows-type membrane whose corrugations are concentric and in a radial plane. As axial fluid pressure increases, it is translated by the corrugations into increasing radial pressure on a sealing ring.

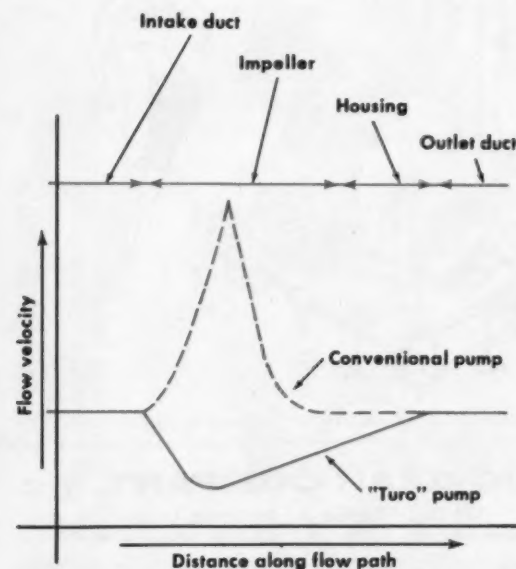
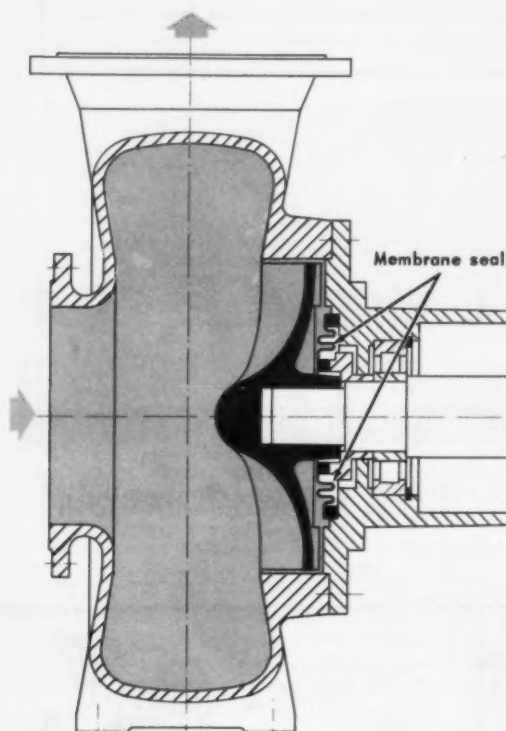
Pumps are available for capacities of 35 to 63,000 cu ft per hr and pressure heads of 2.5 to 216 ft. "TURO" pumps are a development of Emile Egger & Co. AG, Cressier, Switzerland.



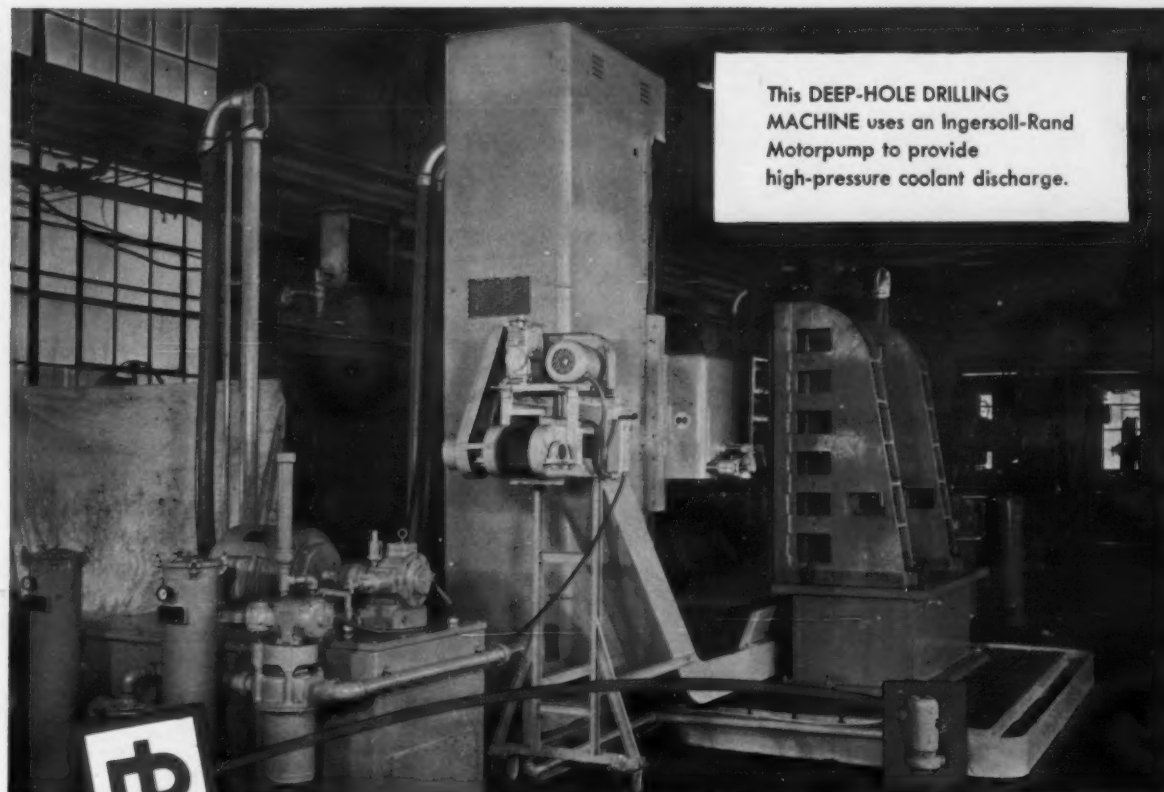
SCHEMATIC FLOW PATTERN



## Fluid by Vortex Action



COMPARISON of flow velocities in conventional and "TURO" pumps.



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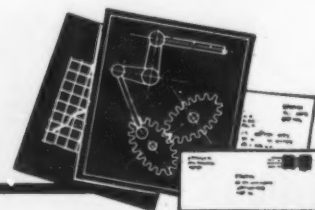


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## IDEA MART DESIGN NEWS

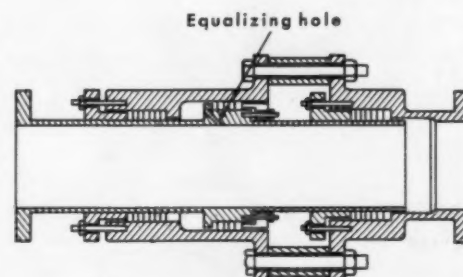
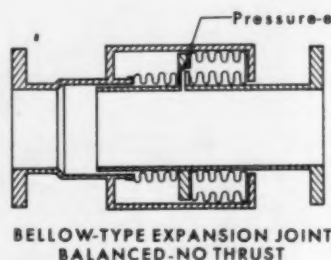


Ideas described in this department are in various stages of development and may be at any point from "initial concept" to "patented".

### AVAILABLE

#### Expansion Joint

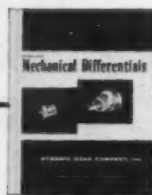
This balanced-type expansion joint solves problems of anchoring the pipe and eliminating destructive thrust. The joint should reduce installation time and costs. Carrying the idea further, the balancing force could be designed to be larger than normal thrust, thereby putting the piping system in tension rather than the customary compression. Write IM 534, Idea Mart, DESIGN NEWS, 3375 S. Bannock, Englewood, Colo.



### Designing a Differential?

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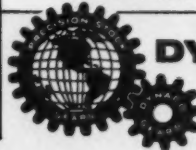
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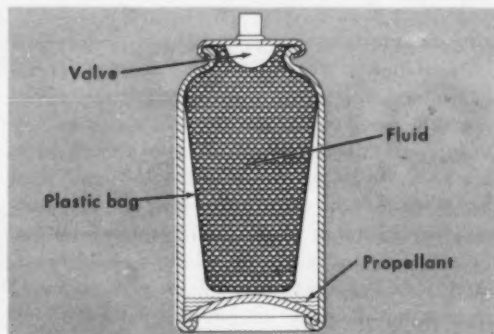
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DESIGN NEWS—OCTOBER 27, 1961

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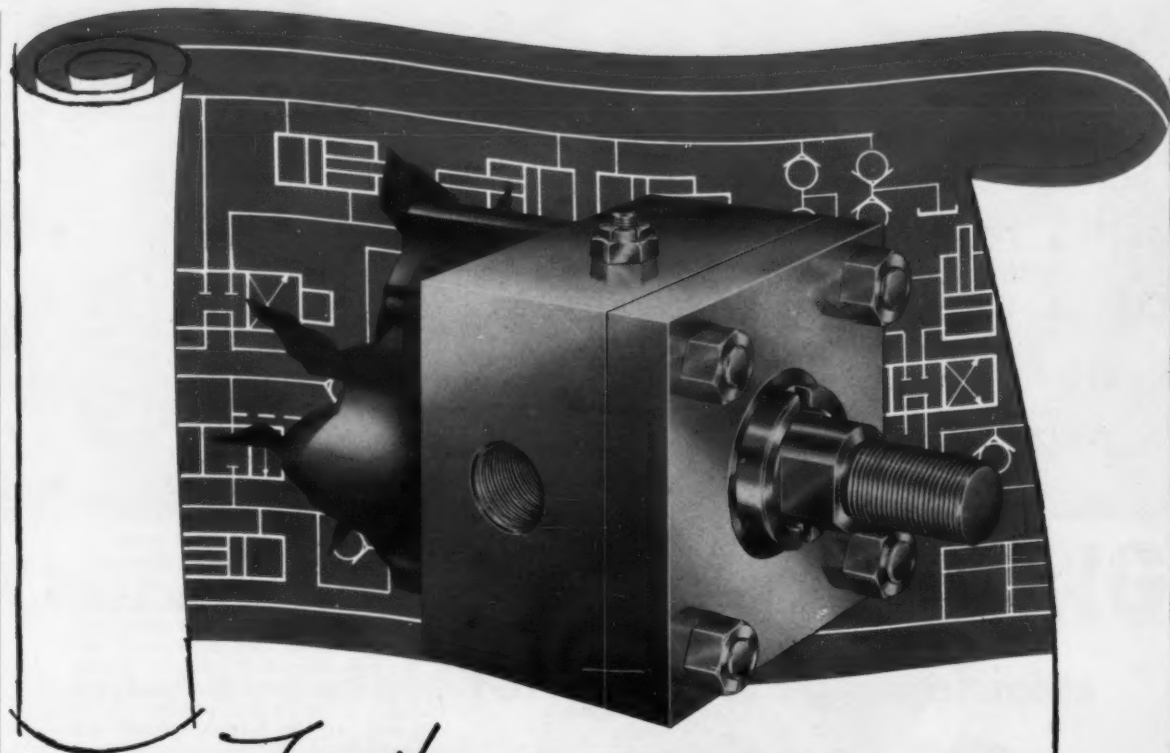
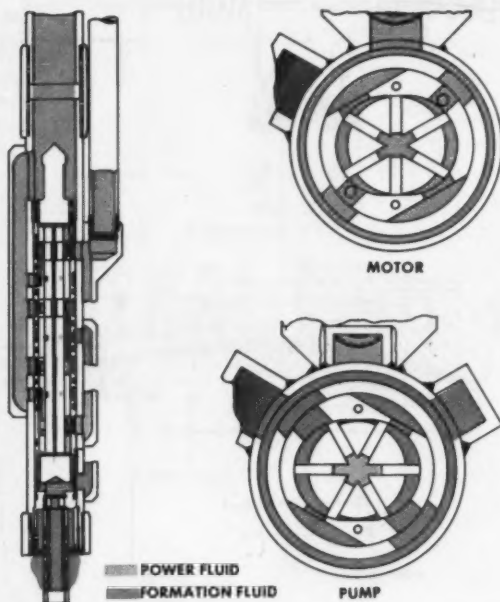
### Self-Pressurized Fluid Dispenser

This dispensing system was designed from systems originally developed for aircraft and missile expendable fluid systems. The system eliminates problems with aerosol-type dispensers in which fluid to be dispersed and propellant are mixed. The device as presently developed can be adapted readily to the retail consumer market given the packaging envelope and fluid to be dispensed. Write IM 533, Idea Mart, DESIGN NEWS, 3375 S. Bannock, Englewood, Colo.



### Hydraulic Pump for Oil Wells

The pump carrier (fishing neck) is screwed into the body which carries O-rings and assembly. The assembly consists of two spring-loaded vane motors and one vane pump locked in place by the rotor base. The base is screwed into the other end of the pump body. The pump vanes carry clean power oil, which is supplied through clearance between rotor shaft and rotor sleeve. Thus, sand and other abrasive material are contained in the cam cavity, minimizing damage. The screen is attached to the rotor base to catch objects larger than 0.01 inch. Would like to contact interested manufacturer. Write IM 532, Idea Mart, DESIGN NEWS, 3375 S. Bannock, Englewood, Colo.



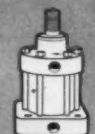
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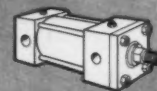
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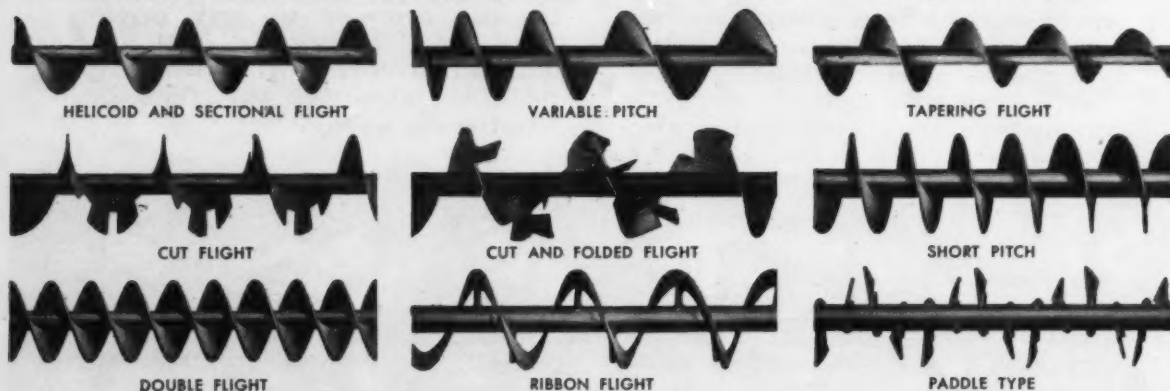
Link-Belt can also furnish helicoid and sectional fighting in a wide range of sizes, plus *all* other screw conveyor components. This includes troughs, spouts, hangers and drives.

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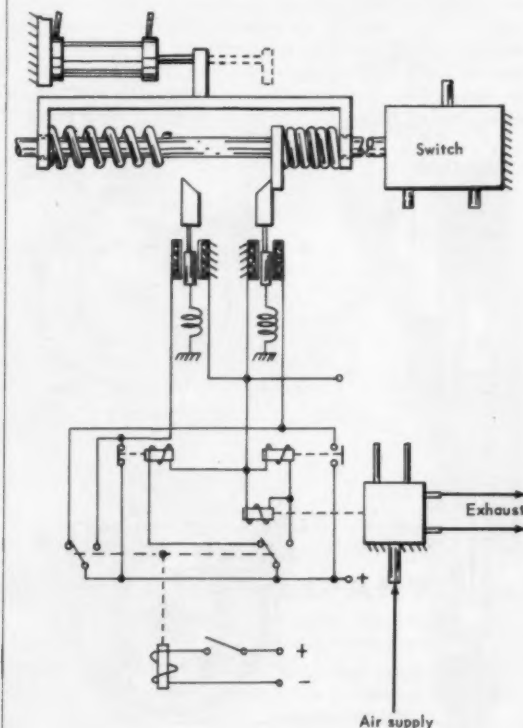
## PATENTS

### High-Speed Actuator

U. S. Patent 2,984,065; William B. Stuhler, Dallas, Tex., assignor to Collins Radio Co., Cedar Rapids, Iowa.

Essentially a high-speed electromechanical switch actuator, this invention refers to a bidirectional switch-actuating mechanism with rapid cycling. The unit is initiated almost instantaneously upon the selective operation of a cooperating electrical circuit.

Translation of the actuating rod occurs at a predetermined distance in either direction upon throwing an electrical switch to first and second positions. As illustrated, the rod is in cocked position ready to be translated to the left upon disengagement of the trigger. The trigger is actuated by a tension spring so that it allows movement of the actuating rod when the solenoid no longer is energized. Upon triggering from this position, the rod moves to the left and the mechanism is cocked for the opposite direction of travel. A yoke holding the two compression springs is actuated by an air cylinder so that it moves in a direction opposite to the motion of the actuator rod upon initiation of a switching cycle. The relay control circuit is arranged to provide the proper sequential operation of the cylinder as well as to operate the two trigger solenoids.



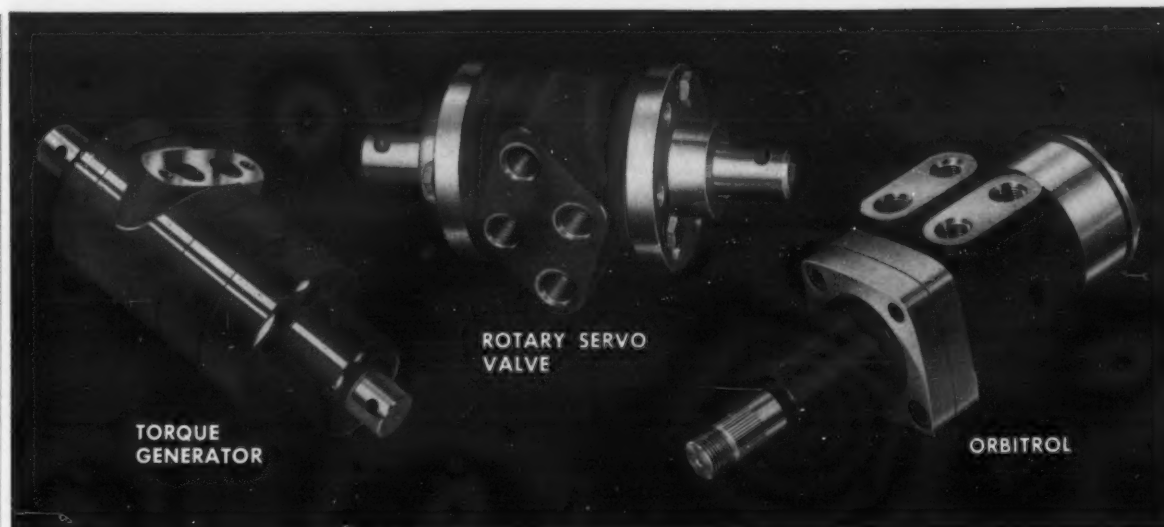
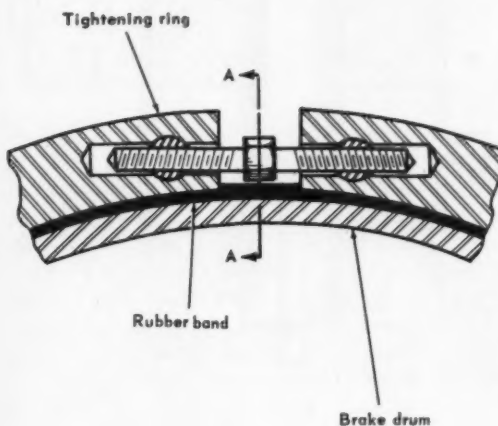
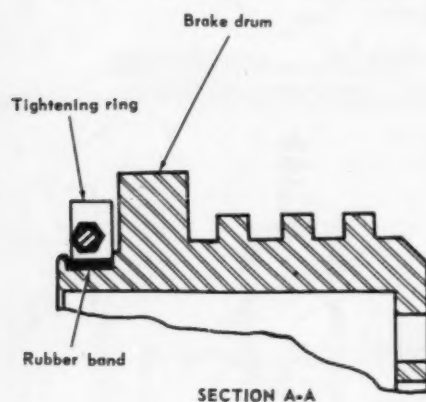
## Brake Squeal Damper

British Patent 857,043; Aktiebolaget Scania-Vabis, Sodertalje, Sweden.

Noise-producing high-frequency vibration in automobile brakes is damped by compressing an elastic band in a circumferential recess adjacent to the drum open end. The band is clamped firmly by a rigid, rectangular-section, steel tightening ring constructed in halves and drawn together by turn-buckles.

Silicone rubber, with high elasticity, high energy absorption and resistance to heat generated in heavy-duty vehicle drums, is used for the band. Best results are obtained by making bandwidth about six times the thickness.

The rigid tightening ring does not tend to straighten locally under vibration and the rubber, possessing much greater energy absorption than steel, absorbs more friction energy than if a conventional flexible tightening ring is used.



# Char-Lynn POWER STEERING

**Now available for all Types of Vehicles**

**3 Basic Controls • 30 Standard Models**

**TORQUE GENERATOR** is used to furnish **POWERED OPERATION** or **TORQUE AMPLIFICATION** to mechanical steering systems.

This remarkable steering control contains both a Servo Valve and Orbit Motor which delivers up to 1,100 in. lbs. of torque output at 1,000 PSI system pressure. Manual effort at the steering wheel is approximately 30 in. lbs.

Direct thru linkage within the unit provides means for manual steering of the vehicle during "engine off" or emergency conditions.

**ROTARY SERVO VALVE** is a remote control for steering systems where it is desirable to actuate the linkage by a hydraulic cylinder. Pressure feed-back provides "load feel" at the input shaft proportional to operating pressure. Also contains direct thru linkage for manual steering.

Although designed primarily for power steering systems, this versatile valve has unlimited use in other applications requiring remote servo control.

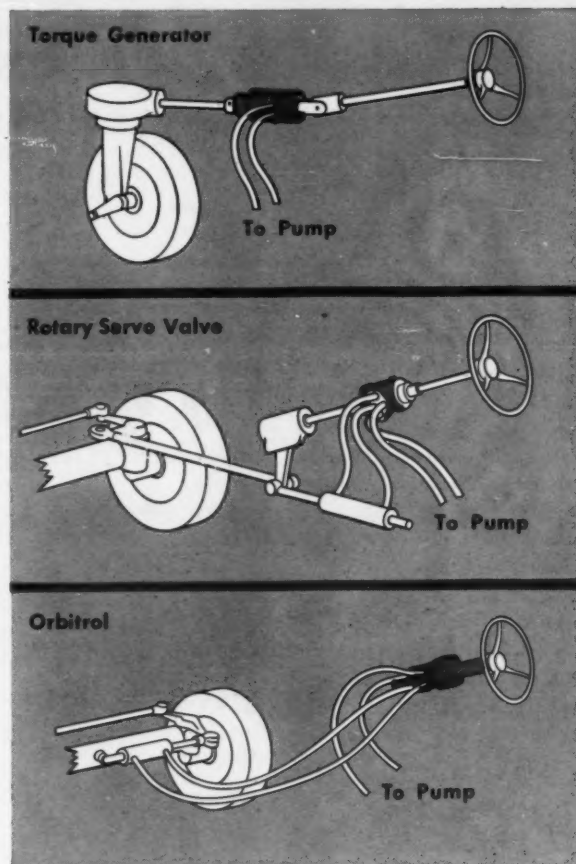
The all new **ORBITROL** is a completely integrated fluid steering control that eliminates any mechanical linkage to the axle. The **ORBITROL** provides remote rotary servo control with sensory direction and delivery measurement within the same unit.

The hydraulic motor section of the Orbitrol functions as a metering device during normal power steering operation and reverts automatically to a rotary hand-pump for emergency manual control.

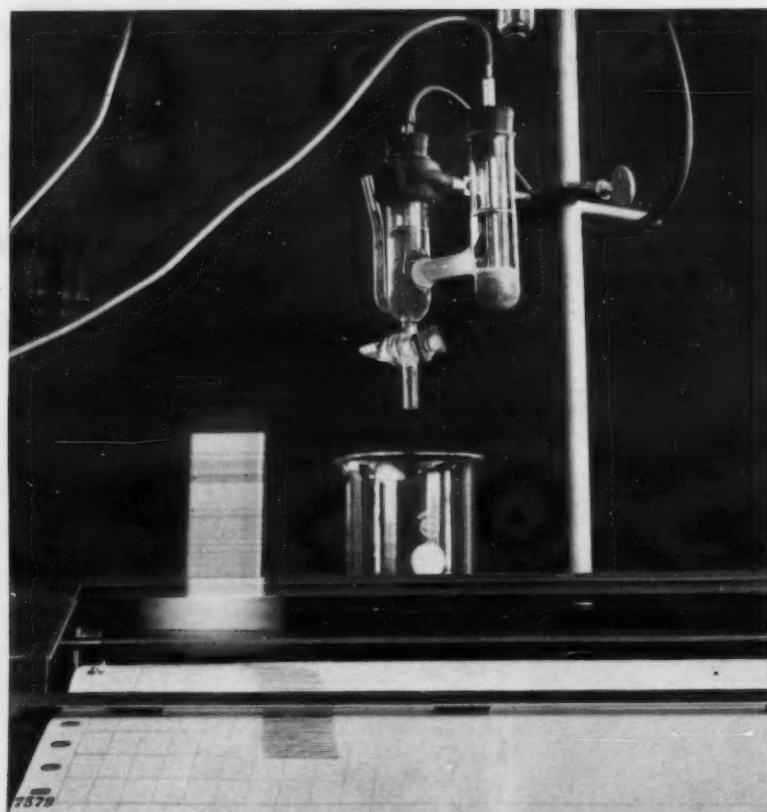
For complete information write:



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# ANALYTIC "BLOODHOUND" SNIFFS OUT SECRETS OF BEARING CORROSION



## WE USE THIS HYPERSENSITIVE DEVICE TO TRACK DOWN ENGINE BEARING CORROSION TO ITS SOURCE.

This instrument needs only a minute fragment of metal for accurate analysis. Consequently, engine bearing corrosion can be traced from its beginning through complete destruction of the bearing surface. Because test variables are minimized, Federal-Mogul engineers can accurately relate degree of corrosion to specific engine operating conditions. This analytical tool is in continual use in our laboratory, assisting research on many different projects. Prevention of corrosion and development of new bearing alloys are high on the list!

## SUCCESSFUL BEARING PERFORMANCE

depends on selecting the proper alloy for the operating conditions to be met. Federal-Mogul engineers have had years of experience with bearings and applications of all kinds . . . and this wealth of knowledge is available to bearings users. This is one reason why F-M sleeve bearings, precision thrust washers, formed bushings, and low-cost spacers are chosen for use in virtually everything from baby buggies to heavy industrial cranes.



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bushings spacers  
thrust washers

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There's much valuable data in our Design Guides on sleeve bearings, thrust washers and bushings; and in our brochure on spacers. For your copies, write Federal-Mogul Division, Federal-Mogul-Bower Bearings, Inc., 11055 Shoemaker, Detroit 13, Michigan.

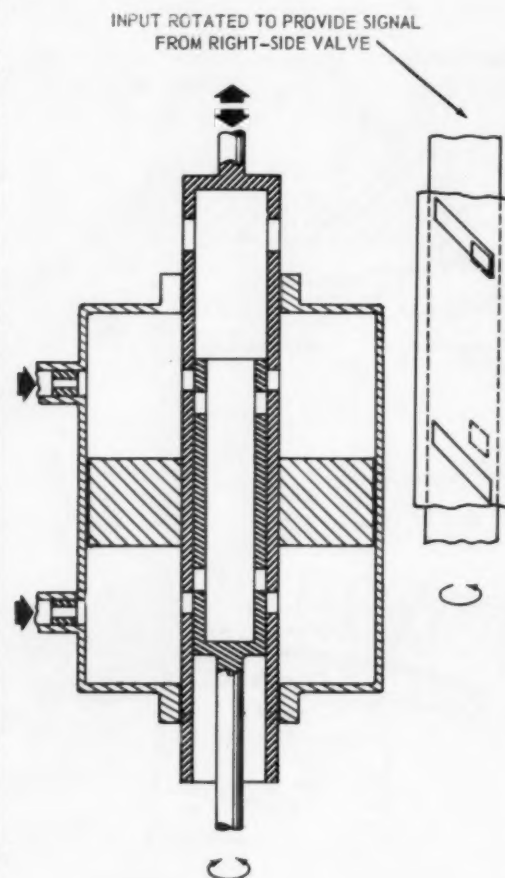
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## PATENTS

### Rotary to Linear Servo Actuator

U. S. Patent 2,992,633; Paul M. Stiglic, Wickliffe, and Donald D. Carrell, Cleveland, Ohio, assignors to Thompson Ramo Wooldridge, Inc., Cleveland, Ohio

This invention is a method for obtaining linear motion from a rotary input hydraulically. The mechanism consists of a housing with two inlet ports, a piston and hollow piston rod capable of limited movement back and forth within the housing, and a hollow input shaft with slanted ports connecting with similar ports in the piston rod. Flow occurs only during periods of actuation. The invention is intended both for air or liquids. The inventor claims that resolution may be improved over previous devices for linear output by as much as a factor of 10. Gain of the servo actuator is a function of the helix angle of the second valve port of the follow-up valve member and is also a function of the radius of the control valve member. Specifically, it is the radius times the tangent of the helix angle.



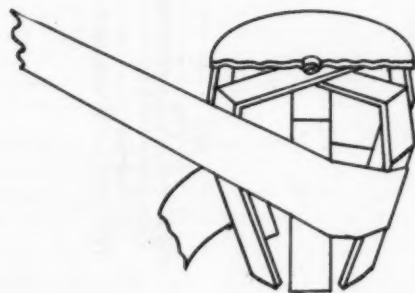
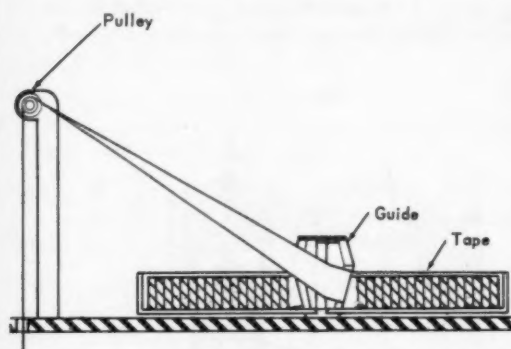


## Recording Tape Guide

British Patent 864,756; James Woodhead, International Computers and Tabulators, Ltd., 17 Park Lane, London, W. 1., England.

A simple rotatable guide consisting of three equally spaced metal strips is used for unwinding magnetic or paper tape from the center of a spool. The strips are bent to form two truncated base-to-base conical surfaces. The cone base line is slightly above the top edge of the tape roll.

After passing around the guide, the tape is twisted through 90 deg, led over a pulley and fed



through a conventional reader which provides the drive. If the pulley is at a suitable height, the tape lower edge clears the roll upper edge.

Upward/inward slope of the upper conical surface enables the tape to twist without undue stress. At the same time, the tape is guided upward by the lower conical surface. The force exerted by the tape when being unwound, in conjunction with the downward/inward slope of the lower cone, prevents the tape from sliding up the guide.



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The Aprilaire® high-capacity furnace humidifier will never have a problem from heat, rust or corrosive impurities of water. Manufactured by Research Products Corporation, it's housing is of CMPC-molded special-purpose phenolic . . . designed to permit easy accessibility for inspection and maintenance if necessary. The motor housing, drain pan and distributing pan are all integral molded-in parts of the neat, compact main housing. A bonus feature is soundproofing—helping make the unit whispering quiet.

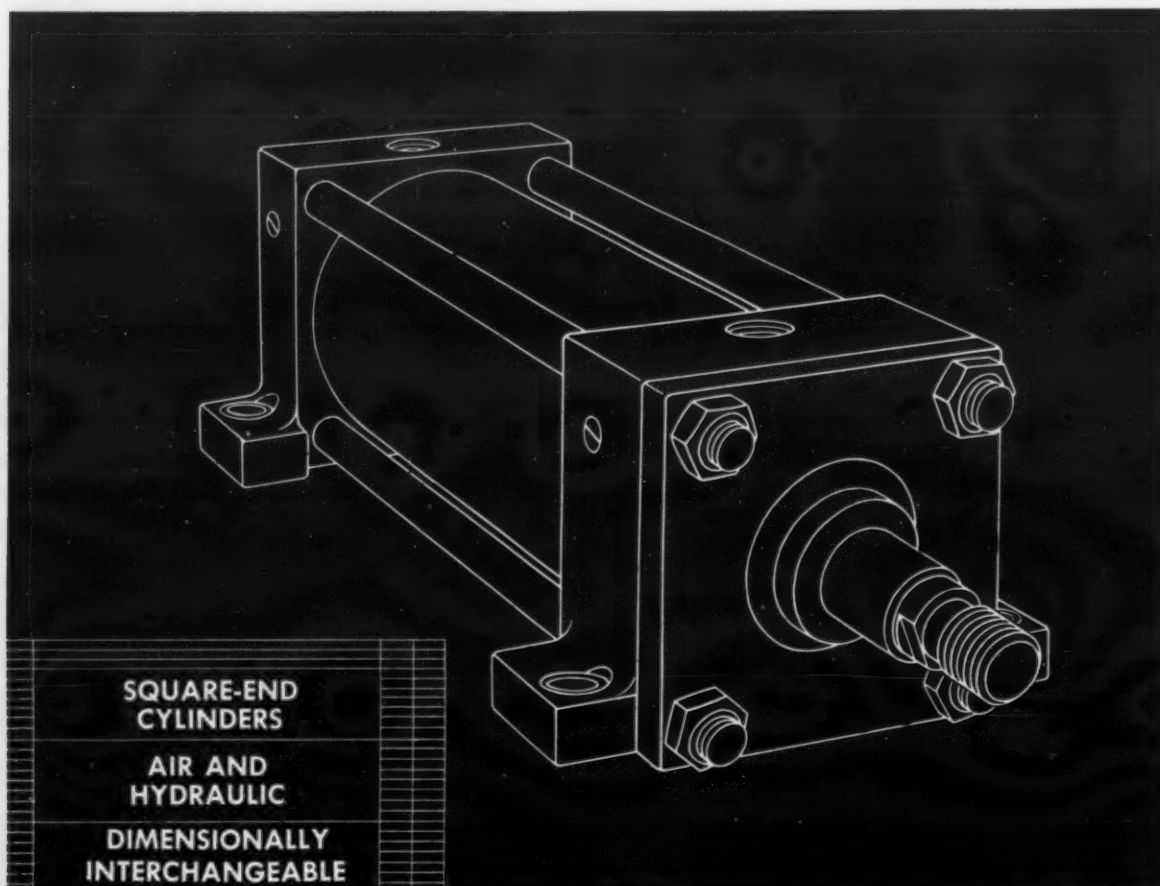
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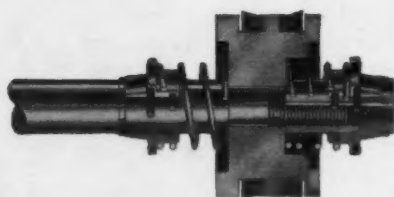
# CMPC

CHICAGO MOLDED PRODUCTS CORPORATION  
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Chicago 51, Illinois

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Design News



## How MEAD takes the **BUMP** out of high-speed pistons



### FULL FLOATING CUSHIONS

Detail shows two-stage feature of full floating cushion on a piston used for hydraulic pressures over 250 psi. MEAD Square-End Cylinders also offer these other design advantages:

- Seamless, hard drawn, micro-finish brass barrel for long piston seal life
- Cold drawn steel cylinder heads with all surfaces permeated with black oxide for rust resistance
- High tensile chrome plated steel piston rods
- Accurately machined rod bearing cart-ridge made of solid bearing bronze

Special full floating cushions in new MEAD Square-End Cylinders are uniquely mounted on springs rather than on solid studs. The result is a smooth, high-speed piston advance without the use of ball checks. In hydraulic units, the two-stage design of the floating cushions completely eliminates bumping. Fully adjustable from the slightest measurable cushioning effect to complete stoppage, the full floating feature also reduces cushion wear caused by impurities in the working medium. In air models up to 250 psi and hydraulic units up to 1000 psi, MEAD Square-End Cylinders are available in a full range of bore, stroke and piston sizes. Complete selection of mounting styles. All units are dimensionally interchangeable and conform to JIC specifications. For consultation and information on quick delivery and competitive prices, write to MEAD today.

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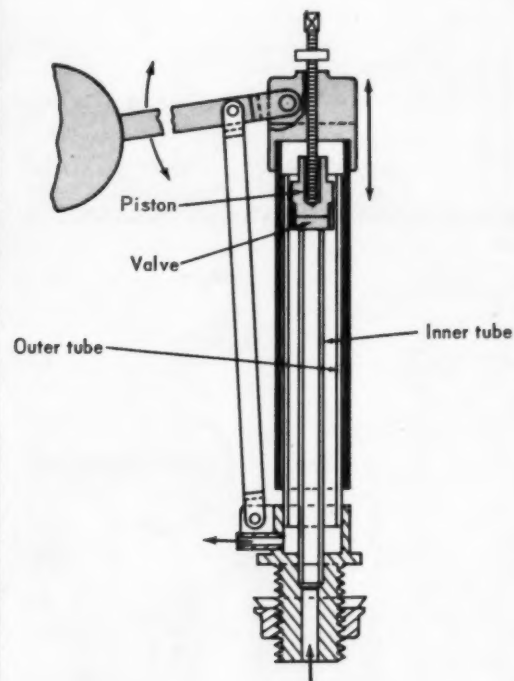
Circle 33 on Reader-Service Card for more information

## PATENTS

### Valve

British Patent 866,677; Vannet Crighton, James T. Crighton and son, 32 King's Road, Dundee, Angus, Scotland.

The valve covered by this patent is designed to eliminate noise caused by flowing water. Two coaxial tubes on a common base are separated by a wide annular space. In operation, noise from flow through the passages is absorbed by the inner tube and damped by the water in the annular space surrounding it. Similarly, noise from water issuing from the valve seat formed by the inner tube upper end is absorbed within the annular space. Increased damping is provided by the water flowing comparatively slowly through the



wide space and entering below water level in streamlined flow.

Two coaxial tubes are enclosed in a hollow cover made from a sleeve and cap arranged to slide on the outer tube. An operating lever, secured to a fulcrum lever and pivoted to the sliding cover, carries the float at its free end. Float movement operates the piston through a pin threaded through the cover into the piston head. Pin adjustment defines the valve setting, and hence water level.

The following list compiled from recent issues of the Patent Gazette gives you increased coverage of new patents whose details may be useful to product and machine designers. Copies may be obtained from the U. S. Commissioner of Patents, Washington, D. C. The price is 25¢ each.

#### SHAFT MOUNTING

U S Patent 2,998,716; Michael L. Rizzone, Dallas, Tex., assignor to United States Steel Corp.

#### FLEXIBLE COUPLING DEVICE

U S Patent 2,998,717; Kurt Schwenk, Dusseldorf, Germany, assignor, by mesne assignments, to Mobay Chem. Co., Pittsburgh, Pa.

#### PRESSURE-BALANCED GEAR PUMP

U S Patent 2,998,783; John C. Lee, 703 N. Elmhurst Ave., Mount Prospect, Ill.

#### ESCAPEMENT MECHANISM

U S Patent 2,998,873; Albert Burstein, Drexel Hill, Pa., assignor to Radio Corp. of America.

#### SELECTIVELY ENGAGEABLE CLUTCH

U S Patent 2,998,874; John H. MacNeill, Melbourne, Fla., assignor to Soroban, Inc., Melbourne, Fla.

#### THREE-SOLENOID MIXING VALVE

U S Patent 2,998,919; James Clarence Budde, Detroit, Mich., assignor to American Radiator & Standard Sanitary Corp., New York, N. Y.

#### EXPANSION JOINT

U S Patent 2,998,986; Frank S. Buono, Garfield, N. J., assignor to United States Rubber Co., New York, N. Y.

#### SELF-ALIGNING SHAFT AND HYDROSTATIC BEARINGS ASSEMBLY

U S Patent 2,998,999; Calvin S. Morser, Wellesley, Robert E. Maloney, Stoughton, and Conrad H. Benoit, Dedham, Mass., assignors, by mesne assignments, to Northrop Corp., Beverly Hills, Calif.

#### SNAP-IN CONTACTS FOR ELECTRICAL CONNECTORS

U S Patent 2,999,221; Roger H. Ellis, Arcadia, and Ernest W. Kuehl, San Fernando, Calif., assignors to Cannon Electric Co., Los Angeles, Calif.

#### REACTION MOTOR

U S Patent 2,999,357; Albert W. Elling, Rte. 2, Hampton, Iowa.

#### VARIABLE VOLUMETRIC HYDRAULIC COUPLINGS

U S Patent 2,999,361; Ambrose E. Zierick, 212 E. 182nd St., Bronx 57, N. Y.

#### HIGH-PRECISION DIAPHRAGM-TYPE INSTRUMENTS

U S Patent 2,999,386; Russell Wolfe, Lexington, Mass., assignor to Trans-Sonics, Inc., Lexington, Mass.

#### DRIVE GEAR AND CLUTCH ASSEMBLY

U S Patent 2,999,397; Gustave Walter, 15 Thorne St., Jersey City, N. J.



## How piston rings of TEFLON® eliminated fire hazard and saved \$4,500 per year

### CAN YOU AFFORD NOT TO USE TEFLON?

- Piston rings of Du Pont TEFLON are your most economical choice whenever product contamination is a problem . . . whenever maintenance costs should be cut . . . whenever lubrication should be reduced or completely eliminated.
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- Rings of TEFLON are not brittle . . . resist chipping, cracking, breaking . . . installation, storage, and handling are easier.
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Oil contamination in an instrument air system caused serious problems in a large manufacturing plant. Oil plugging the lines not only led to heavy maintenance costs, but also created a dangerous fire hazard. Converting the eight instrument air compressors to piston rings of TEFLON solved the problems and saved the plant money.

The greatly reduced lubrication required with rings of TEFLON (no oil at all was added to the cylinder) eliminated the oil contamination and system plugging. In addition to cutting the plant's maintenance costs substantially, the rings of TEFLON lasted longer than the previously used carbon rings, saving \$3,000 per year in ring cost, and virtually eliminated cylinder wear, saving another \$1,500 per year in cylinder refinishing.

If you are buying a new compressor, specify rings and packings of a TEFLON TFE resin. To convert your present equipment, check with your compressor manufacturer or qualified ring supplier for engineering and design assistance. For further information, write: E. I. du Pont de Nemours & Co. (Inc.), Dept. DN-10-T, Room 2526, Wilmington 98, Delaware.

In Canada: Du Pont of Canada Limited, Box 660, Montreal, Quebec.



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FLUOROCARBON RESINS

TEFLON is Du Pont's registered trademark for its family of fluorocarbon resins, including TFE (tetrafluoroethylene) resins and FEP (fluorinated ethylene propylene) resins.

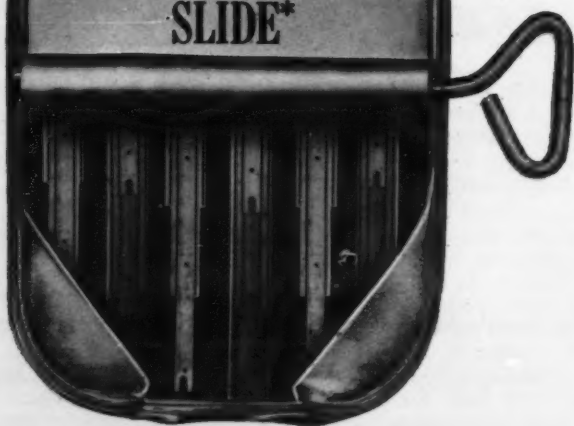
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ENOUGH FOR  
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SLIDE\***



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## GRANT INDUSTRIAL SLIDES

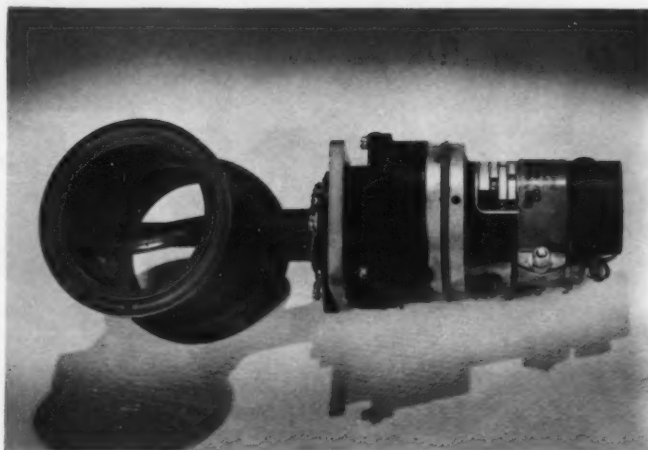
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EASTERN DIVISION/ 19 High Street, West Nyack, N.Y.  
WESTERN DIVISION/944 Long Beach Avenue, Los Angeles, 21, Calif.

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## DESIGN DESIGN IDEAS NEWS

### Diodes Give Three-Wire Control to Split-Shunt Motor

Edward W. Schrader, Western Editor



**SPLIT-SHUNT MOTOR** for reversing duty drives modulating butterfly valve. Shunt winding gives more torque at lower speeds.

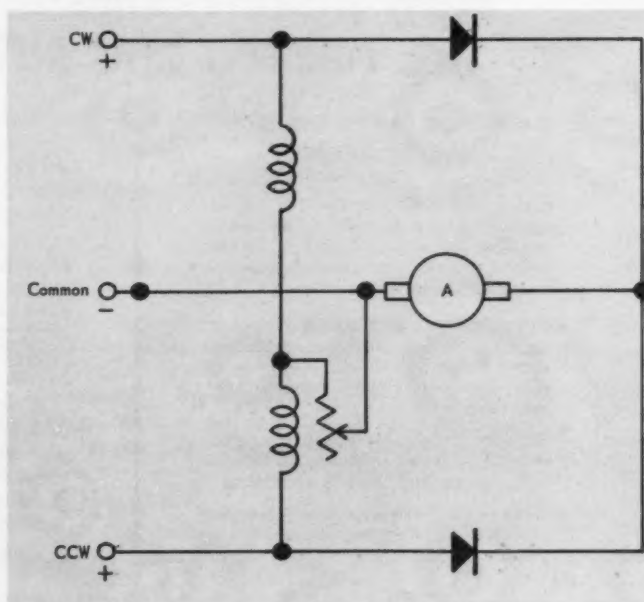
Diodes inserted between the field coils and the armature make a split-shunt reversing motor. A single-pole, double-throw switch reverses motor direction. When used in servo systems, the power can be applied in both directions simultaneously to get a shaft output from the differential voltage input.

The shunt-wound motor has not approached the popularity of the series or split-series wound motor, in spite of the highly desirable speed-torque curves of a shunt motor and the inherent speed regulation, which is at least 20 times that of the series-wound motor with varying loads or supply voltages. Formerly, the extreme complexity of reversing and switching shunt motors obviated their use in spite of their desirable characteristics.

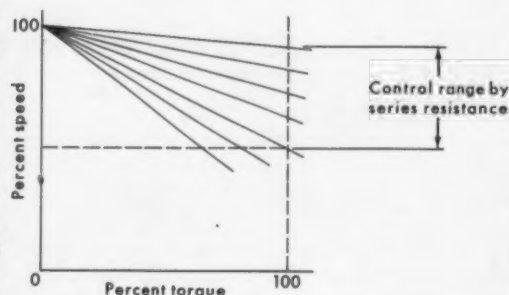
The slope of the speed-torque curve can be varied by a series resistance inserted into the field of the shunt motor circuit. Speeds in either direction can be varied by changing the resistances in the individual field sections.

The split-shunt circuit can be used to provide a multiple characteristic motor. Although the basic unit uses three leads, a five-lead unit can be produced. As an example, the No. 1 lead could be the common; the No. 2 lead could be a shunt motor running CW or CCW at 5000 rpm; No. 3 lead could be a shunt motor running CW or CCW at 10,000 rpm; the No. 4 lead could be a compound characteristic motor operating at 15,000 rpm in either direction, and the No. 5 lead could be a series motor operating at 25,000 rpm in either direction.

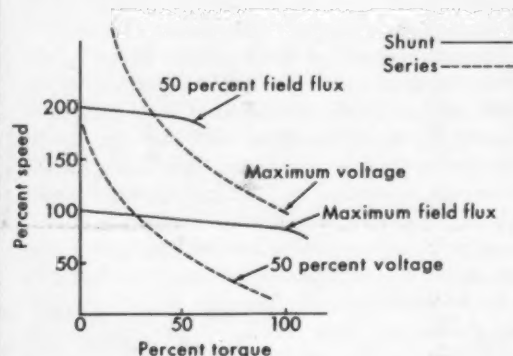
The patented split-shunt motor is a design development of J. W. von Brimer, Transco Products, Inc., Santa Monica, Calif.



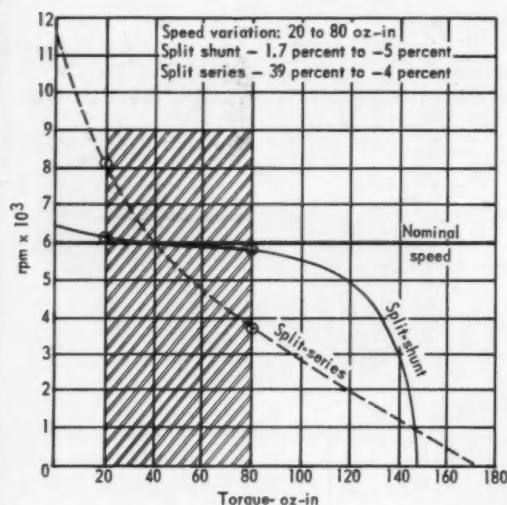
**SCHEMATIC DIAGRAM** of split-shunt motor with rheostat between split field windings and common line. Diodes allow independent or simultaneous energizing of each shunt field for simplified three-lead reversibility. Rheostat reduces field voltage for speed control in either direction.



**SPEED-TORQUE** characteristics obtained by inserting resistance in series with armature circuit of shunt-wound d-c motor. Additional resistance decreases slope of speed-torque curve.



**SPEED-TORQUE CURVES** of shunt motor with reduced field-flux control and series motor with normal and reduced voltage. Because of higher field-flux density, much higher efficiencies are obtained by split-shunt at light loading. Field control to shunt-wound motors gives almost constant power output through speed ranges in order of 8:1.

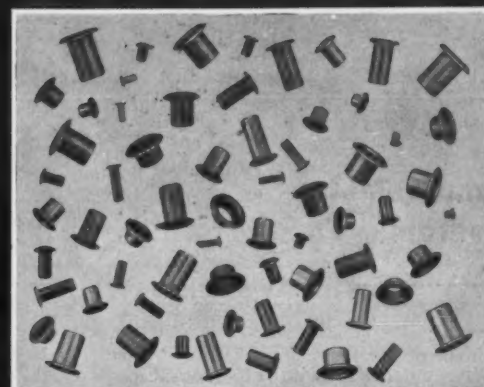


**PERFORMANCE COMPARISON CHART** of split-series and split-shunt motors. Of interest to systems designers is linearity of speed-torque curve of split-shunt motor in region of nominal speed. Where speed regulation requirement permits this type of motor, mechanical governors can be eliminated.

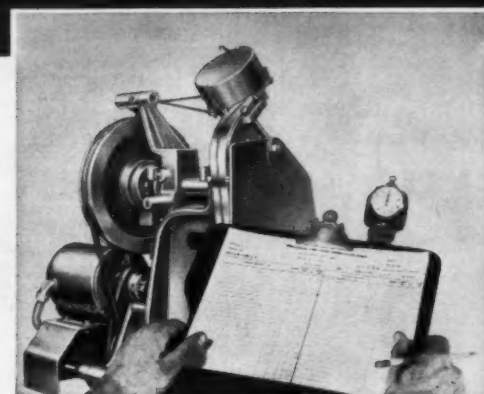
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## Lightweight Hydraulic Pump

301

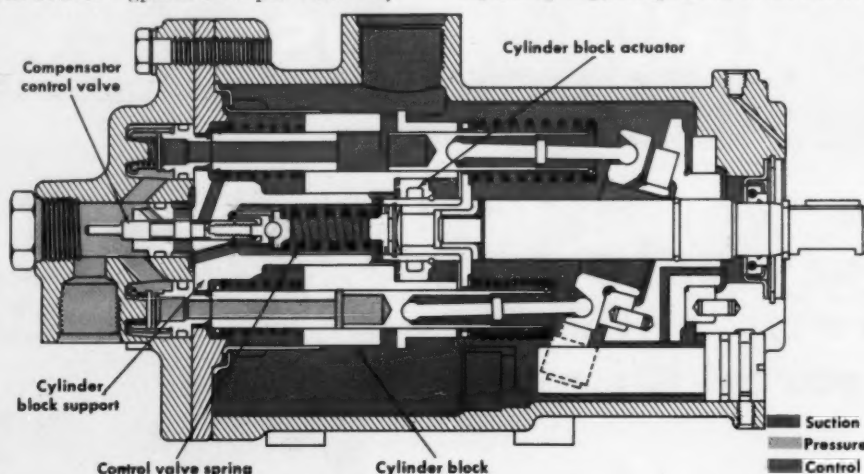
### With Axial Pistons

A variable displacement hydraulic pump, having control versatility, high speed and pressure capability, and high overall efficiency, is now available on a mass-production basis. At a speed of 3600 rpm, the pump will deliver 9 gpm at 3000 psi. Versatility

of the new pump is attributed to its balanced cylinder block and wobble-type reaction plate design which nearly eliminates pumping forces from the displacement-changing mechanism. Reaction pistons serve to balance the hydraulic forces exerted on the cylinder block during pumping. There are seven cylinders in the pump, each with a piston, connecting rod and low-mass check valve. Each constitutes a separate pump, independent of the others but phased

to a common outlet port. The use of individual discharge check valves makes the pump immune to cavitation effects prevalent in pumps incorporating port plate valving, even at inlet vacuums to 20 inches of mercury or below. Direct cylinder-block actuation at low force level provides sensitive, fast response and stable control of pump output. The nonrotating cylinder block does away with centrifugal forces acting on reciprocating components, allowing a substantial increase in the maximum speed of the pump. Nominal speed range is designed to fall between 450 and 4500 rpm. Operation is at a high level of efficiency since the drive shaft and cam are its only two rotating components. Side loads on the pistons are minimized by long self-aligning connecting rods having spherical seats. Reduction of side thrust on pumping pistons assures long service life, permits the use of fluids of extremely low lubricity in the standard pump configuration and allows high-temperature operation. The pump can operate continuously at no flow while maintaining full system pressure without an increase in drive power.

Weatherhead Co., 300 E. 131st St., Cleveland 8, Ohio.



## Hydraulic Actuator

302

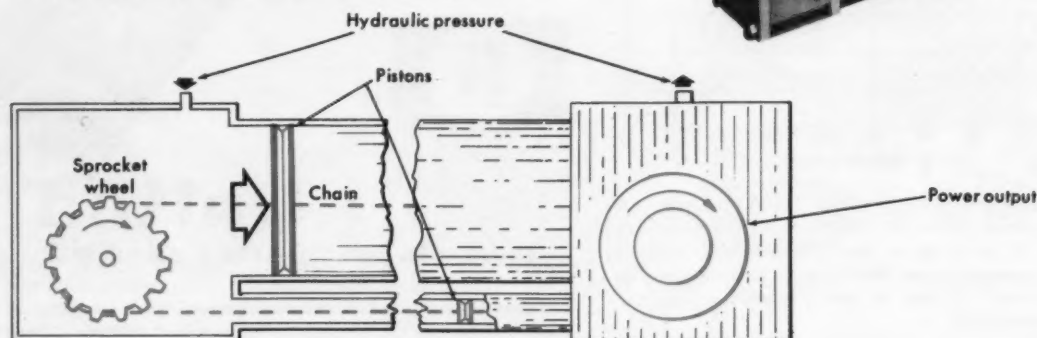
### Provides Rotary Motion

This rotary actuator provides a means of converting hydraulic or pneumatic power into uniform rotational motion. Power is derived from the motion of a self-centering piston rigidly coupled to a continuous chain. The actuator is said to be without backlash and sensitive to minute changes in the actuating fluid. The pistons are "Teflon"-sealed and may be used with hydraulic fluids or air without requiring lubrication. Air or fluid under pressure is introduced at one end where it exerts unequal forces on the two pistons because of the difference in their areas. The force on the larger piston being greater causes it to move to the low-pressure end of the cylinder which pulls the chain rotating the drive shaft. A greater pressure introduced at the opposite end reverses the direction of rotation. Standard units provide 90 deg of rotation but gear trains may be included in the power head to increase the number of revolutions. Models may be supplied with a power shaft at each end, operating at equal or at

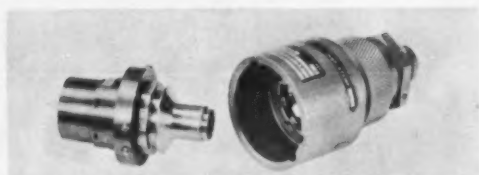
different speeds. Clutches and backgear combinations may be used to allow continuous stepping operations. When used for precision positioners, automatic chain tensioners can be supplied. Fifteen standard models are available, ranging in output from 10 lb-in torque to as high as 30,000 lb-in torque. The largest model measures 15 inches high by 10.75 inches wide by 20 inches long. Applications for the actuator, called a "Rota-Cyl", are operation of fork-lift trucks, drill presses, motor tools, valves, mixers, pressure regulators, torque amplifiers,

conveyors, wiper motors and precision torque wrenches.

Graham Engineering Co., Box 11494, Palo Alto, Calif.





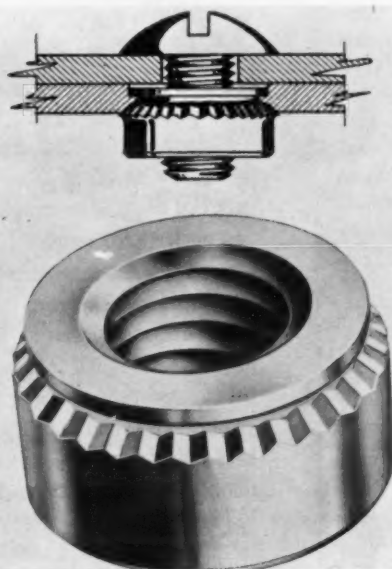


Mistakes are impossible when using these indexed fluid connectors. Using key-and-slot indexing, nine different combinations are obtainable in any given connector size. Available in 1/4 through 1-inch line sizes in 1/8-inch increments, these units are rated at 3000 psi operating pressure and 7500 psi bursting pressure. Temperature range depends upon which of several sealing materials is used. The standard model is constructed of aluminum, although stainless steel is available on special order. The N4R Series "Inst-O-Matic" connectors are supplied with dust caps and pressure caps are available upon request.

E. B. Wiggins Oil Tool Co., Inc., 3424 E. Olympic Blvd., Los Angeles 23, Calif.

### Threaded Inserts for Sheet Metal

304



These threaded inserts are said to be installed quickly, using standard shop tools. For use in sheet metals as thin as 20 gage, the units have a unique angular knurl which is said to positively prevent loosening or turning of the insert in its hole. The inserts are made of case-hardened, cadmium-plated steel and the thread length equals or exceeds that of standard nuts. Eight sizes are manufactured, ranging from 4-40 to 1/4-28.

South Chester Corp., Southco Div., Lester, Pa.

### Access Fasteners:

## How Quick is Quick?

By J. K. Barry  
Chief Product Engineer  
Southco Div., South Chester Corporation

A dangerous temptation to overspecify often creeps into the process of calling out a quick-access fastener. It becomes possible even for the most experienced product designer to place so much emphasis on speed of operation that other aspects of good design practice may suffer.

Except in rare cases it is doubtful that a difference of 2 to 4 seconds in the time required to actuate a fastener will be a vital matter to the operator. This is especially true when only one or two fasteners are used on a door or panel. The access time element, however, becomes more significant when a greater number of fasteners must be operated to open a single door.

Of equal importance in the selection of a fastener are such considerations as simplicity of design, strength of construction, smoothness of operation, and ability to overcome panel deformation and variation in material thickness.

A quick release fastener that will perform smoothly under conditions of precise alignment and uniform material thickness might be difficult or slow to operate where thicknesses vary and doors become misaligned. But a fastener designed to open with several turns (or a quarter-turn pawl fastener with a self-adjusting feature) might offer quicker access and less trouble by compensating for variations in material and alignment.

Select a fastener suited to the conditions of your application. Look for one that can be purchased from stock and installed easily with standard production equipment.

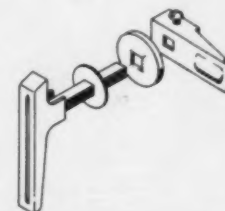
Consider fastening in the early stages of design. You'll avoid the unpleasant choice between redesigning your package at the last minute, or inventing an expensive fastener to fit it.

Shown below are some basic forms of the turn-operated quick-access fastener as made and stocked by Southco. Many major variations in design as well as differences in size, head style, etc. will be found in the new Southco Fastener Handbook. Send for your free copy today. Write Southco Div., South Chester Corporation, 232 Industrial Highway, Lester, Pa.



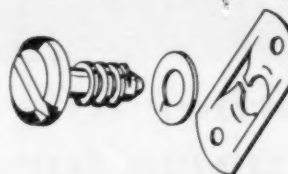
#### Lion Quarter Turn Fastener

For split-second actuation. Meets Mil Spec MIL-F-5591A (ASG). Excellent under conditions of vibration or where a number of fasteners must be used on the same door.



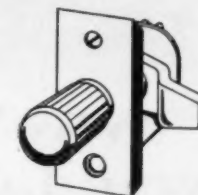
#### Universal Cabinet Latch

Quickly attached to door with special push-on clip. Fits any door or frame thickness; operates with a quarter turn. Excellent for large doors of gauge metal.



#### Southco Screw Fastener

Opens with two or three turns. Rugged, quickly installed. Overcomes misalignment of door and frame, tolerates variation in material thickness and deformation of panels.



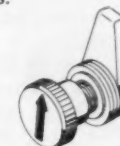
#### Adjustable Fastener

Pre-assembled and quarter turn operated; latches against frame (even against a rough casting surface). An extra turn of the knob tightens door to compress gasketing, resist vibration. Fits variety of door and frame thicknesses.



#### Retractable Screw Fastener

Easily installed by flaring stand-off into door. Captive screw assembly engages tapped hole in frame, needs no receptacle. Ample float tolerates misalignment.



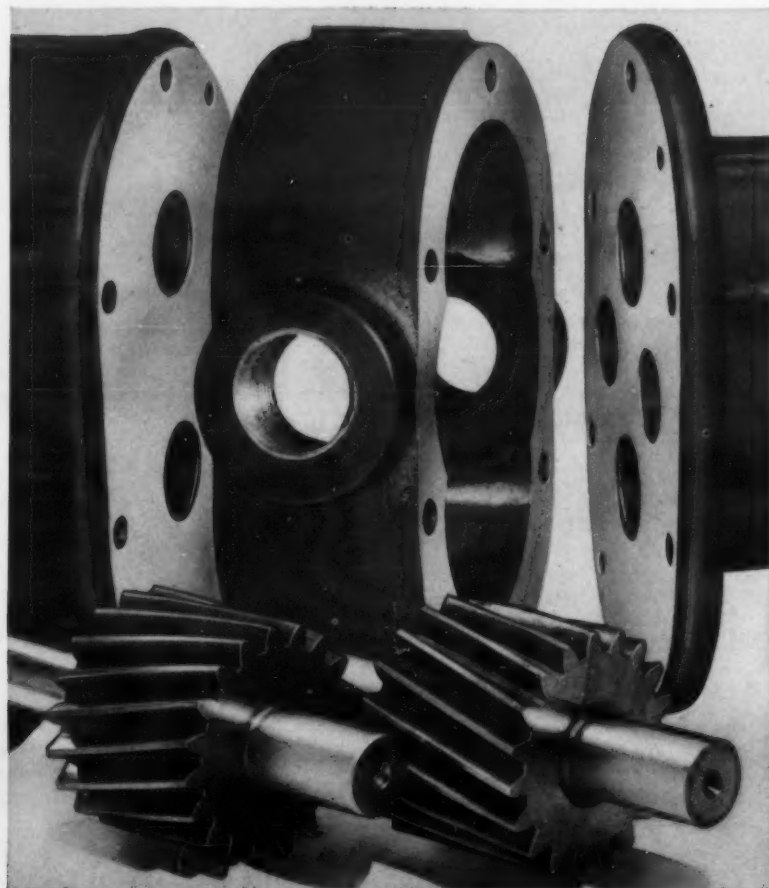
#### Panel Latch

A spring-loaded, quarter turn latch assembled with one set screw. Uses minimum inside space. Arrow indicates pawl position, permits visual inspection.



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## Why we bother to grind these parts for Brown & Sharpe Pumps

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You can even see the difference by simply comparing the surface finish on the gears, shafts, and housing faces of a B&S pump with pumps made by most other manufacturers.

Try it! You'll see why B&S pumps are extra-dependable . . . they go right on pumping when other pumps have quit. Write for details to Brown & Sharpe Mfg. Co., Providence 1, Rhode Island.



Extra-dependable B&S rotary gear pumps are used in every major industry. Pressures: to 1000 psi — Capacities: to 175 gpm — Viscosities: 50 to 50,000 ssu.

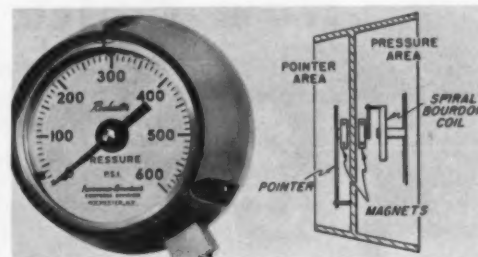
**Brown & Sharpe**  
PRECISION CENTER

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## MECHANICAL

### Pressure Gage with Safety Wall

305



A solid metal wall between the pointer and the high-pressure areas of this gage eliminates the danger of gage-glass explosions in industrial plants. Coupling from the pointer to the pressure element is accomplished by using two permanent magnets on either side of a solid-aluminum divider. By using a spiral bourdon tube, a full 270-deg dial indication is provided without using the links, pivots, gears and hair springs found commonly in other gages. The resilience of the spiral coil allows the gage to withstand extensive cycling without wear. The unit conforms to military specifications MIL-G-18997 and MIL-S-901. Allowable overpressure is rated to 130 percent of the scale range and bursting pressure is two times maximum scale range. Hysteresis, friction and backlash are said to be below readable limits, while accuracy is 1/2 of 1 percent of the full scale range. The gages may be obtained in pressure ratings from 0-100 to 0-10,000 psi and with several connection options. While originally designed to meet high-shock Navy specifications, the gages should find application in many industrial environments.

American Standard Corp., Controls Div., 5900 Trumbull Ave., Detroit 8, Mich.

### Fire-Safe Valve

306

Under simulated fire conditions, the "Teflon" seat of this ball valve sublimates, permitting the ball to shift against the chamfer, forming a perfect metal-to-metal seal that withstands a maximum pressure of 1000 psi. The floating-ball type valve features interchangeable seats of "Teflon", neoprene, "Buna-N" and nylon to meet a broad range of requirements. The valve is available in forged stainless steel, carbon steel or brass, in eight sizes (1/4 through 2 inches). Applications include use in the petroleum, chemical, food processing and other industrial piping systems.

Clayton Mark & Co., Forged Steel Products Div., 1900 Dempster St., Evanston, Ill.

not  
just balls  
but  
precision  
balls  
made from  
many  
materials  
with  
finer  
finishes  
and closer  
tolerances

Don't let our name Hartford Steel Ball confuse you. Yes, we make steel balls, but more than that we have researched and developed other precision balls, balls of a wide variety of materials, balls that meet the exacting new production demands. Our facilities and experience are at your service. There are Hartford sales engineers in Major U.S. cities and Canada. Let us recommend the ball for you before you find you have a problem. Our newest and most complete ball catalog is a handy reference for quick precision ball selection. Just sign your name to your company letterhead and address to us. A copy will be mailed promptly.

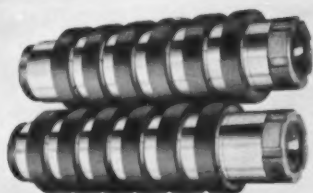


Hartford Steel Ball Company 39  
Jefferson Ave., West Hartford, Conn.



### Gang Slitter with Carbide Knives

307

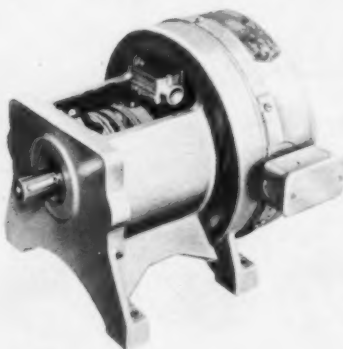


Using carbide-rimmed knives, this gang slitter may be used for a wide range of materials, including high or low-carbon steel, silicon, tin-plate stock, aluminum, copper and brass. The knives, with tungsten-carbide outer rims and alloy-steel bodies, are reported to hold their cutting edges 10 to 15 times longer than conventional high-alloy slitting knives. The knives, complete with arbors and spacers, can be furnished in a wide range of sizes.

Cowles Tool Co., 2086 W. 110th St., Cleveland 2, Ohio.

### Cycling Drives

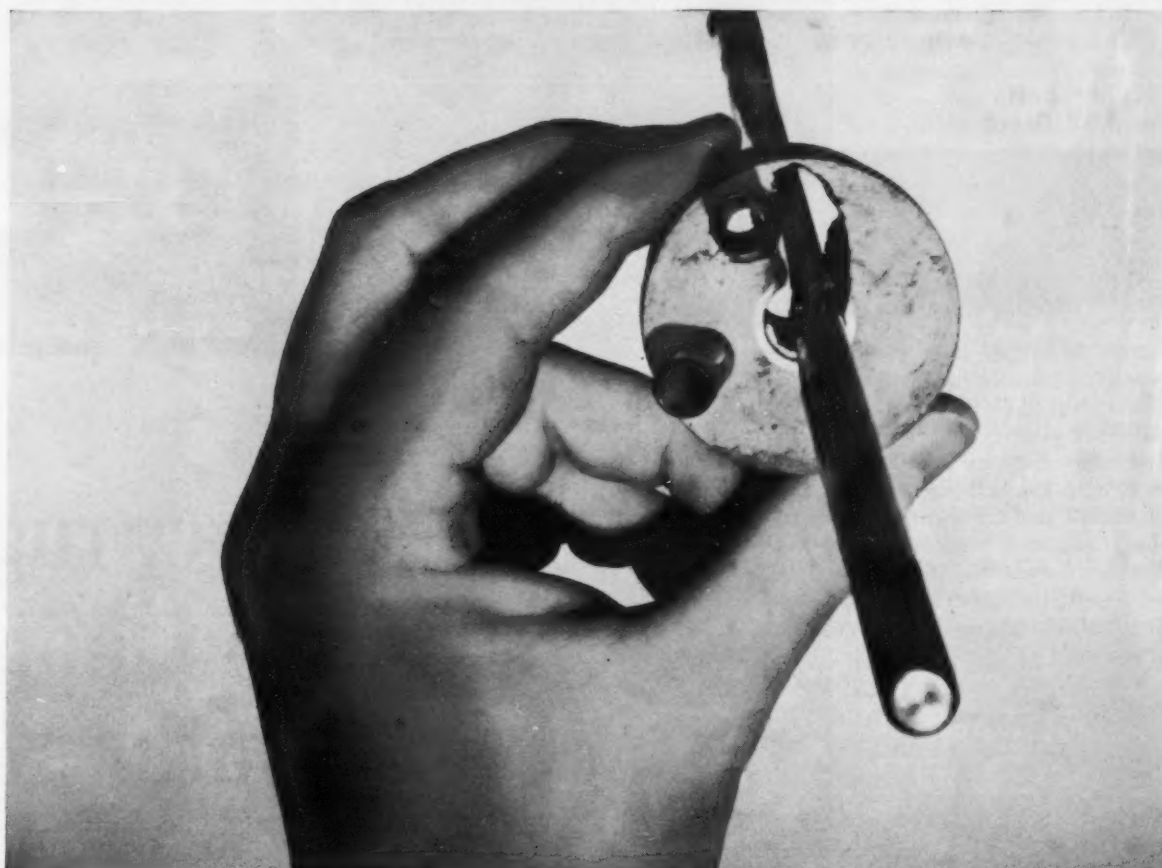
308



Providing energy storage to meet momentary peak loads up to 10 times their average load ratings, "Vari-Power" drives include a compact axial air gap motor and an integral clutch-brake coupling. A high-inertia rotor achieves the necessary flywheel effect. The drives are capable of short cycle time for fast stops and starts. The clutch can be actuated through a time-delay relay and the brake can be applied through use of a position-indicating switch to provide adjustable cycle timing. With rheostats the unit may be adjusted for slip-clutch usage. Drives have ratings from 1/3 to 7 1/2 hp and are made for 1200, 1800 or 3600 rpm. They are also available with double-enveloping worm speed reducers mounted on the output shaft or connected through a timing belt. Variable-speed drives also can be provided with output speeds variable over a 3:1 range.

Ferguson Machine Co., 7818 Maplewood Industrial Ct., St. Louis 17, Mo.

### Wear like this led to replacement of 7 metal parts by ADIPRENE



Highly abrasive glass dust caused this reciprocating rod to cut entirely through a metal bearing and most of the cylinder rod end plug in a UNIFIL® loom-winder used in glass fabric weaving. An ADIPRENE bearing was still performing well a year later, after more than 200 million strokes.

## ADIPRENE® still at work after 200,000,000 strokes...on a job too tough for metal bearing

Tiny glass particles ground gaping holes in vital metal parts on glass fabric weaving equipment. An obvious solution was substitution of non-metallic parts. But when conventional rubbers and plastics were tested, failure again occurred. ADIPRENE urethane rubber, however... with its excellent resistance to abrasion, plus its combination of hardness, resilience, and load bearing capacity... tested so successfully that now seven ADIPRENE parts are used in the same loom-winding

machine. These parts reduce downtime and increase quality by making possible continuous runs of the glass fabric.

ADIPRENE can help you in the design of better, longer-lasting parts. It is oil-resistant, machinable and has outstanding electrical properties. For detailed information on the unusual combination of properties of ADIPRENE, write E. I. du Pont de Nemours & Co. (Inc.), Elastomer Chemicals Department DN-10, Wilmington 98, Delaware.



Conventional rubbers were also tested for textile machinery parts. ADIPRENE far outlasted all metals, plastics and rubbers.



**ADIPRENE®**  
URETHANE RUBBER

Better Things for Better Living... through Chemistry

Circle 39 on Reader-Service Card for more information



## MECHANICAL

### 'Mylar' Belts for FHP Drive

309

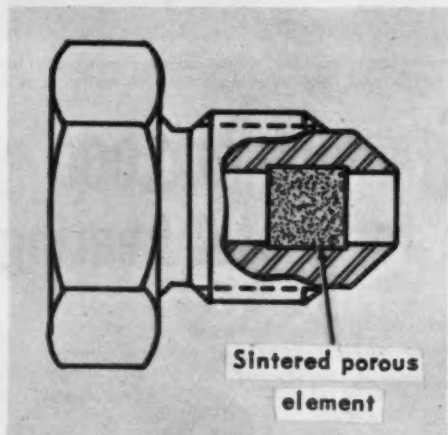


Suited for flutter and slip-free precision power transmission in the fractional horsepower range, belts made of Du Pont "Mylar" are obtainable in lengths to 48 inches, in widths to 1 inch and in thicknesses from 0.5 to 10 mils. The belts are strong, tough, durable, stable and are resistant to extremes of shock, vibration, temperature and humidity. The belts often can replace gear, endless woven belt, flat rubber belt and O-ring drives in critical satellite and other instrumentation applications.

Kinelogic Corp., 1256 N. Fair Oaks Ave., Pasadena, Calif.

### Flow Restrictor Gage

310



Pressure gages used in hydraulic or pneumatic systems are sometimes subject to damage from surges or shocks in the lines of the system. Flow restrictors or snubbers are now available to protect gages against these surges. The snubber is constructed of corrosion-resistant steel containing a porous plug made of bronze, corrosion-resistant steel or "Monel" metal with a porosity of 2, 5, 10, 25 or 50 microns. The restrictors are offered in a large assortment of styles and sizes.

Remm Co., 7955 Haskell Ave., Van Nuys, Calif.

Circle 40 on Reader-Service Card



## Now! A new rugged line of versatile foot switches from Cutler-Hammer

*Smartly styled... four types... designed to be used many different ways*

Now you can get the same high quality in foot switches you find in Cutler-Hammer motor starters.

Our new foot switches are designed to be stepped on, kneed, elbowed, palmed or whatever method you can think of to use them. Heavy gauge metal and rugged construction will keep these switches operating long after others have failed.

You get versatility, too. The heavy duty, side treadle switch has three interchangeable operating arrangements that can be made easily in the field by just changing the position of a nylon cam, and all are styled

alike to give you uniformity in appearance.

Be sure to get full details from your Cutler-Hammer distributor and send for Pub. LO-91-V272.

#### What's new at Cutler-Hammer?

We've geared up for the great growth of technology coming in this decade... with new, better products like the foot switches, new engineering talent, new plant facilities. If you're planning ahead, let's get together. Maybe we could help you with your electrical control and automation plans. Get in touch with the Cutler-Hammer Sales Office nearest you.

WHAT'S NEW? ASK...

## CUTLER-HAMMER

Cutler-Hammer Inc., Milwaukee, Wisconsin • Division: Airborne Instruments Laboratory • Subsidiary: Cutler-Hammer International, C. A. • Associates: Cutler-Hammer Canada, Ltd.; Cutler-Hammer Mexicana, S. A.

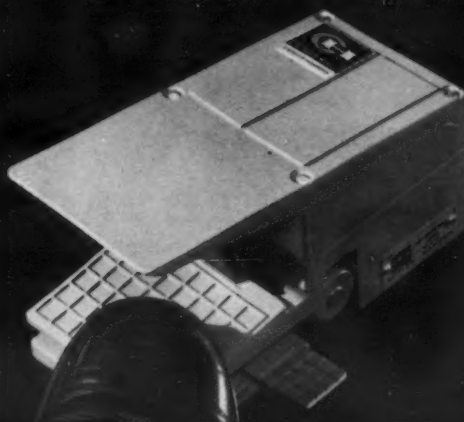


## HEAVY DUTY SIDE TREADLE OPERATED FOOT SWITCH

Most versatile foot switch you've ever seen. Just by changing the position of a nylon cam, you can change the operation of the switch on the job. Comes with four nameplates (Start, Stop, Forward and Reverse). Pick the two you want, toss the other two.



**HEAVY DUTY TREADLE SWITCH WITH FOOT LOCK** Non-slip tread helps keep operator's foot from slipping. Available with several types of guards. Locks when depressed, opens when red release is touched.



**HEAVY DUTY PALM-TYPE SWITCH** Big orange surface easy to see. Rated for 600 volts maximum. Neoprene gasket stays flexible, resists effects of oil.



**STANDARD DUTY TREADLE-OPERATED FOOT SWITCH** Use it for a knee operation. Has a rating of 500 volts maximum. Three mounting bosses permit mounting on uneven surfaces without rocking.

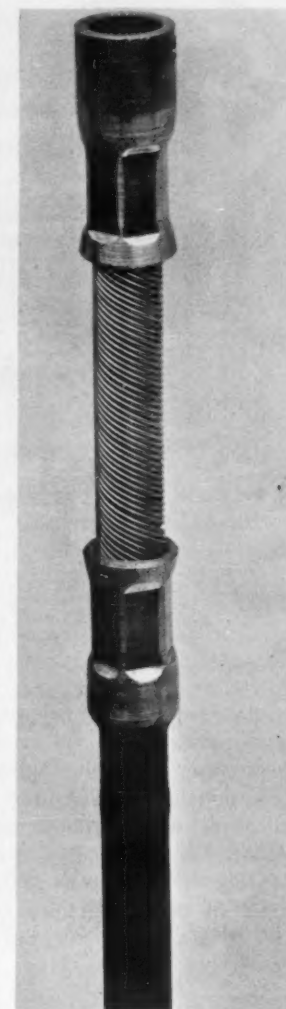


## Flexible Steering Shaft

311

Steering column deflections of as much as 20 deg are possible with this flexible shaft designed especially for the steering column of automobiles, trucks or tractors. In addition to enabling rapid entry and exit from the vehicle, the flexible shaft will collapse in the event of collision, helping to prevent further injury to the driver. The 3/4-inch-sized shaft illustrated has a breaking strength of 4600 lb-in, more than double the maximum load a man can put on a steering column.

Stow Mfg. Co., 443 Shear St., Binghamton, N. Y.



Circle 40 for Reader Service

**D-C Brushless Motor****312**

Through the use of solid-state commutation, this d-c motor eliminates the usual brush commutator assembly. By eliminating the conventional mechanical commutating contacts, the motor produces no radio-frequency interference and removes the need for shielding or filtering. The Model "T" motor will be available in power ranges from 300 mw to 4w input. Standard supply voltages are 12 and 28v d-c. While operating from a d-c sup-



ply, the Model "T" may be locked to an external oscillator and will maintain synchronism over a wide range of applied d-c voltage and/or output loads. The motor has a nominal shaft speed of 3000 rpm, measures 1-1/2 by 1-1/2 by 1-3/4 inches and weighs 4.5 oz. It is designed for use in high-altitude airborne or orbiting equipment.

Brailsford & Co., Inc., 670 Milton Rd., Rye, N.Y.

## Designers think of R/M first for asbestos, rubber,



### Molasses Dairy Feeds Clog Scale Openings

Stainless steel interiors of automatic feed weighing scales have long provided good service for users of Richardson Scales for weighing molasses content feeds. But as molasses content increased, so did the time and effort required for cleaning.

Usually twice-a-day cleaning sufficed. But the higher the molasses content, the faster the feed adhered and built up on all plating. Downtime for cleaning went even higher.

Now Richardson Scale Company uses R/M "Teflon" sheets wherever molasses feed makes contact with the scales. Field experience proves that now scales never clog, cleaning requires only a moist sponge instead of a metal scraper and only 1/10 as much time as before. Problem solving is a natural



### R/M Bondable "Teflon"\* Cuts Cleaning Time 90%

for "Teflon" in applications which utilize its non-adhesive property and low coefficient of friction. Talk to R/M—headquarters for "Teflon" rods, sheets, tapes, hose, machined parts, with or without bondable surfaces. Write for information or call your nearest R/M district office.

\*Registered TM for Du Pont fluorocarbon resins

### PLASTICS



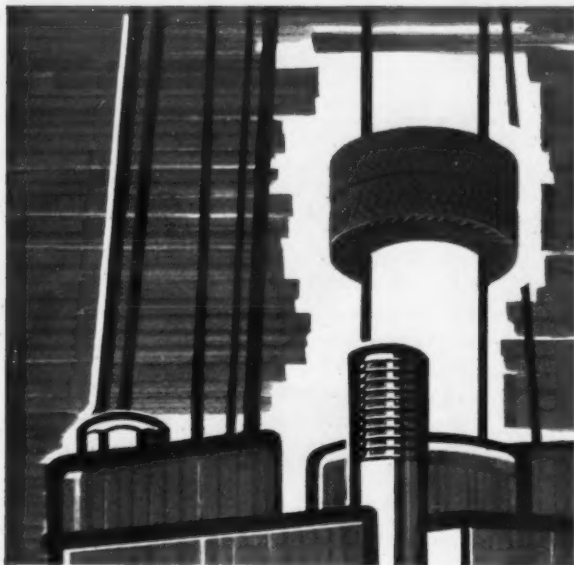
For a copy of this booklet, full of information on R/M's complete line of "Teflon" Products, write Plastic Products Division, Raybestos-Manhattan, Inc., Manheim, Pa.

Circle 41 for more information on Plastics

DESIGN NEWS—OCTOBER 27, 1961



## sintered metal, and engineered plastic products



### R/M CAPABILITY PRODUCES VALVE STEM PACKING of low volume loss at up to 1150°F

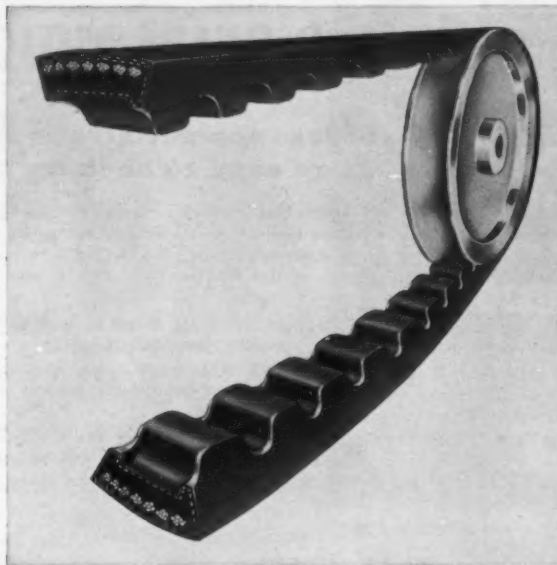
Low volume loss is a basic requirement of high-temperature valve stem packings. Reliable sealing characteristics are assured when valves are packed with R/M No. 325 because total volume loss is *less than 5%*. R/M No. 325 high-temperature valve stem packing is free of the organic materials that make other packings burn out and require much adjustment. Contains AAA grade Inconel-wire-inserted asbestos yarns braided over a plastic core that will not fuse. R/M No. 325 offers an extra dividend in that it contains a corrosion-resistant inhibitor that protects against valve stem pitting after valves are hydrostatically tested and stored.

There are R/M valve stem packings for your every department, each offering superior advantages. Let us know your requirements and depend on us to meet them.

#### PACKINGS



For complete information on R/M Mechanical Packings and Gasket Materials, write for new Catalog P-100. Packing Division, Raybestos-Manhattan, Inc., Passaic, N.J.



### R/M CX MOLDED V-BELT OUTLASTS—AND OUTPERFORMS OTHER BELTS 8 to 1 . . .

Use R/M CX Molded V-Belts wherever more flexibility and ruggedness with quieter, cooler vibration-free operation are required.

- Fully Molded—Fully Jacketed
- No Cut Notches—No Exposed Sides
- Holds Shape and Effective Length Without Stretch
- Vibration-Free—No Slap, No Hum, No Buzz
- No Ply Separation—No Flex-Cracking
- Ideal for Small Sheave Diameters, Short Centers, High Speeds

It's the only notched V-belt of its kind made. Let R/M specialists work with you on V-belts, rubber hose, transmission or conveyor belting, molded or extruded parts.

#### RUBBER



Write today for Bulletin M220 and booklet shown: full details on a wide variety of industrial rubber products. Manhattan Rubber Division, Raybestos-Manhattan, Inc., Passaic, N.J.

## RAYBESTOS-MANHATTAN, INC.

FACTORIES: Passaic, N.J. • Bridgeport, Conn. • Manheim, Pa. • Paramount, Calif. • No. Charleston, S.C.  
Crawfordsville, Ind. • Neenah, Wis. • Peterborough, Ontario, Canada

Circle 42 for more information on Packings

Circle 43 for more information on Rubber



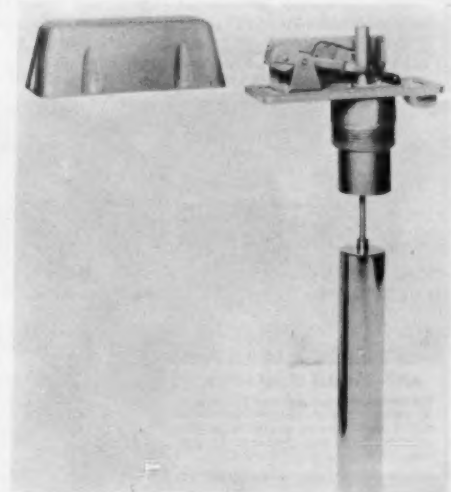
### Miniature Ball Bearings 313



Here is a new line of miniature ball bearings designed for upgrading products presently using sleeve bearings. Intended for use in miniature potentiometers, gear trains, motors and similar equipment, this new line allows the advantages of ball bearings at less cost than the previously available high-precision units. The new bearings range in size from a diameter of 0.5000 to as small as 0.1562 inch.

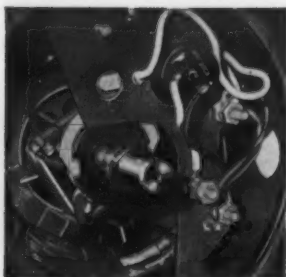
General Motors Corp., New Departure Div., Bristol, Conn.

### Level Transducer 314



Model DLR Module Level Precision Level Transducer converts a measure of liquid level directly to electrical resistance. It is capable of acting as a level-sensing device in open or pressure vessels. A frictionless magnetic coupling transmits motion from level changes in the vessel to contact wiper movement on potentiometer winding inside the housing. A "Ni-span-C" expansion spring is used to suspend a range displacer in the liquid. Various lengths of displacers are available and an adjustment is provided to calibrate the unit for specific gravity variations of 0.7 to 1.1. The device can be used with resistance-type reading instruments for remote level indication, alarm, recording or control, or it can be tied in to computer systems.

Magnetrol, Inc., 5300 Belmont Rd., Downers Grove, Ill.



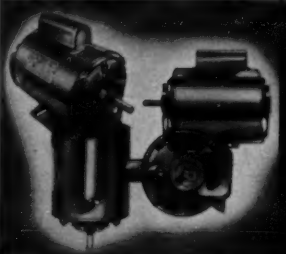
#### Quick Break Switch

The starting winding is disconnected from the line by this Wagner designed switch... test proved to make more than a million breaks. (That adds up to two starts per hour for 50 years!)



#### Quick Connect Terminals

Brass tabs on terminal studs permit quick, easy connection of leads... cut wiring time to speed assembly line production. Simply press the lead receptacle on to the stud—a positive connection is assured.



#### All-Angle Operation

The sleeve bearing design, in fractional hp ratings, has a positive lubrication system that permits operation in any position... can mean important savings in motor costs to manufacturers.

## NO STARTING PROBLEMS

with

## WAGNER CAPACITOR-START MOTORS

**Pack more power into less space...give long troublefree service...are easy to hook up**

Here are general purpose single-phase motors that have high starting torque and high pull-in torque. When used in the proper application and supplied with voltage close to their rating, they'll give positive starts every time. Troublefree operation is assured... thanks to the positive action of the Wagner governor mechanism and long life quick-break switch.

Wagner Type RK Motors pack more power into less space. Small enough to fit in tight spots, their ruggedness is built-in... permits direct mounting. They are available in a range from 1/4 through 5 horsepower, with sleeve or ball bearings, and with rigid bases or resilient mountings. And, sleeve bearing fhp models can be operated in any position.

Get these motors from leading distributors in your city, or from Wagner Sales Offices in 32 cities across the country. Your Wagner Sales Engineer will be glad to help you select the right motor for your application. Wagner Bulletin MU-217 gives full details on Capacitor-Start Motors.

### Wagner Electric Corporation

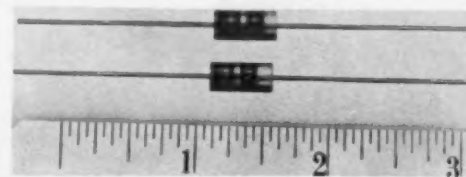
6487 Plymouth Avenue, St. Louis 33, Missouri



## ELECTRICAL

### Epoxy-Sealed RF Chokes

315

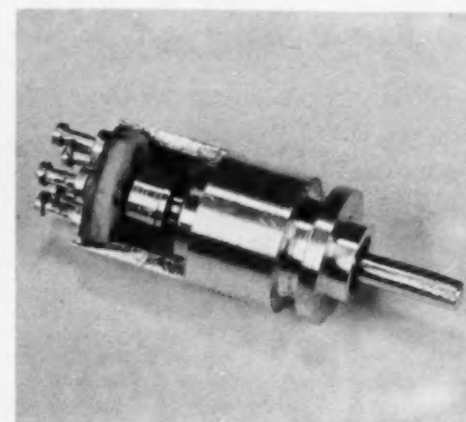


These RF chokes are encapsulated in epoxy resin to provide protection and mechanical stability. They are color-coded for identification of inductance values. The chokes range in fixed inductances from 0.15 to 27.00 microhenries. They have good self-resonant frequency characteristics and high current-carrying capacity. The chokes have been designed to meet or exceed MIL-L-T-7K.

Cambridge Thermionic Corp., 445 Concord Ave., Cambridge 38, Mass.

### Solid-State Generator

316



Type 201 consists of a stationary semiconductor Hall crystal and a rotating magnet, producing desirable features of the Hall effect—high accuracy, power handling ability, low noise, dependability and ruggedness. The magnet is mounted in the rotor, permitting shaft rotation to vary magnetic field strength at the crystal. Miniature bearings to 50  $\mu$ inch tolerance support the shaft and provide rotational speed in excess of 10,000 rpm. Encapsulated in the rear of the unit, the crystal does not require slip-ring contacts. Five terminals are provided for input bias current, output voltage and d-c level adjustment. Output voltage is linear with input current, independent of shaft rotation speed. Variations of the device allow it to be used as a tachometer, an error sensor or a position indicator. Weight of the Type 201 is 1g.

Omnite Co., Box 491, Westminster, Calif.

Circle 44 on Reader-Service Card for more information



**Label  
problem?  
heat  
cold  
gas  
grease**



**scuff  
shock  
vibra-  
tion**



... whenever any of these punishing conditions challenge the labels and insignia you design, specify rugged "Scotchcal" Film. This tough plastic material has its own tenacious adhesive—specially developed by the world's leading adhesives maker. "Scotchcal" Film goes on dry in seconds—just press in place. Wide choice of vivid colors, metallic finishes. **Send for free Design File and samples.**



- Insignia
- Labels
- Nameplates
- Instructional Panels
- Trim

**Scotchcal®**  
BRAND  
FILM

Reflective  
Products  
Division **3M**  
COMPANY

St. Paul 6, Minnesota

Circle 45 on Reader-Service Card

## Image Orthicons with Fiber-Optics

317

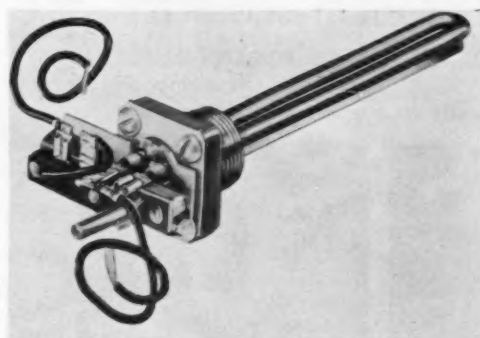


The use of fiber optics in the face plates of two new image orthicons has made possible light transmission gains of up to 50 times the value possible with conventional optics. The new tubes have produced clear pictures at light levels of well below  $10^{-6}$  foot-candles. The image orthicons are designated ZL-7809 and ZL-7810. They are supplied with the S-10 and S-20 photo surfaces, respectively. The fiber-optic tubes can be built with spectral sensitivity from ultraviolet to infrared. Applications include aerial reconnaissance, satellite observation, medical television and astronomy.

General Electric Co., Cathode Ray Tube Dept., Schenectady 5, N. Y.

## Thermostat-Controlled Tank Heater

318



No relays are needed for this line of electric tank heaters. Available in wattages up to 3500 at 240v, the self-contained thermostat contacts will switch loads to 15 amps. Featuring individually replaceable components, these thermostat-controlled heaters make possible a temperature differential of only  $\pm 2^\circ\text{F}$ . The self-contained thermostat is not affected by ambient temperature variations and offers positive burnout protection against dry-tank problems. Uses for the heaters include vending machines, electric radiators and portable water heaters.

Thermo-Craft Electric Corp., 429 E. 164th St., New York 56, N. Y.

## Ferro-Tic\*

"the only machinable carbide"

**Draws  
50,000  
perfect  
stainless steel  
cups**

Here's proof:

WOODHAVEN METAL STAMPING COMPANY, INC. states:  
"Using steel dies to draw 305 stainless steel cups we had to rework the die after every 5,000 pieces. With FERRO-TIC dies we draw 50,000 pieces before even superficial polishing is needed."

FERRO-TIC is the only cemented carbide that is machinable and heat treatable. Fabrication is similar to tool steels; first conventional machining and then quench hardening for ultimate hardness. WOODHAVEN METAL STAMPING, like most FERRO-TIC users, make their own dies with existing equipment, thus, insuring quick service to their customers. In addition to much longer press runs, parts from FERRO-TIC dies are within closer tolerances and have better appearance. Since only superficial polishing is required to renew these dies, their actual production life is more than a hundred times that of tool steel. FERRO-TIC can be used for blanking, deep drawing, heading dies, arbors, core rods, wear parts, etc.



AGENTS THROUGHOUT THE U. S. A.  
WRITE FOR ILLUSTRATED BULLETIN D 10

Division of **CHROMALLOY CORPORATION**  
169 Western Highway, West Nyack, N. Y. • ELmwood 8-5900  
Chromalloy Division, West Nyack, New York  
Chromizing Corporation, Hawthorne, Calif.  
Propellex Chemical Division, Edwardsville, Ill.  
Elyria Foundry Division, Elyria, Ohio  
Shunk Manufacturing Co. Inc., Bucyrus, Ohio

\*Reg. U. S. Trade Mark

Circle 46 on Reader-Service Card for more information

## Design News

*stimulating Design  
Activity through...*

**USABLE  
DESIGN  
IDEAS**



\*JACK designed by LEONARDO DA VINCI, 1452-1519



## General Electric Makes Eddy-current-coupling Drives

And they're dependable drives. The complete line includes water-cooled and air-cooled eddy-current couplings. We call them **KINATROL**\* drives. Ratings are from 1 to 150 horsepower, operating from standard a-c power.

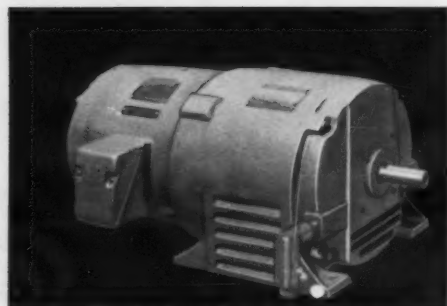
A General Electric **KINATROL** drive is not just another eddy-current coupling. For instance, in the water-cooled coupling, water control is packaged. You'll see much less external piping. Furthermore, the coupling is protected from flooding—and the air gaps are dry, preventing corrosion.

**KINATROL** couplings are compact, field proven and dependable. General Electric has had a good deal of experience in the engineering, manufacturing, and application of packaged adjustable-speed drives. And we know how important service is to a customer.

**KINATROL**—a good product, with the kind of service you can depend on. Please call your nearest General Electric Sales Office for further details.

\*Trademark of General Electric Company

821-07



AIR COOLED, 7-1/2 to 100 HP



WATER COOLED, 25 to 150 HP



AIR COOLED, 1 to 5 HP

DIRECT CURRENT MOTOR AND GENERATOR DEPARTMENT

**GENERAL  ELECTRIC**  
ERIE, PENNSYLVANIA

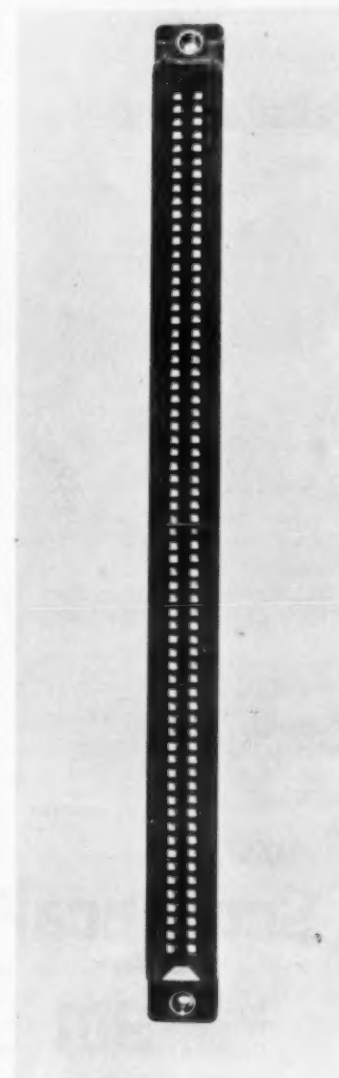
## ELECTRICAL

### Printed-Circuit Connector

319

Measuring only 1/2 inch square by 7.6 inches long, this printed-circuit connector features 130 contacts. Contacts are beryllium copper, gold over silver plate, on 0.100-inch centers. The double-row connector has staggered terminations which make soldering easier. The unit is for use in missiles, aircraft, computers or other electronic instruments.

Viking Industries, Inc., 21343 Roscoe Blvd., Canoga Park, Calif.



Circle 47 on Reader-Service Card

## Three-Phase Breaker

320



All three phases are interrupted at once with this circuit breaker. Models are available with either manual or automatic reset. The manual model is available with ratings of 100 ma to 6 amps; the automatic at 100 ma to 10 amps. The breakers are enclosed in "Bakelite" and will interrupt as much as 440v.

E-T-A Products Co. of America, 6284 N. Cicero Ave., Chicago 46, Ill.

## Compensated Force Washers 321



Actually miniature load cells, these force washers have temperature compensations better than 0.5  $\mu$ inch/inch/deg F over a range from 50 to 250F. The miniature load cells maintain linearity, repeatability and hysteresis accuracy of better than  $\pm 1$  percent of full scale. They can be supplied in standard bolt sizes ranging from 3/16 to 1 inch in dia. Loads in this range vary from 5000 to 35,000 lb, depending on bolt diameter selected.

Lockheed Electronics Co., Avionics & Industrial Products Div., 6201 E. Randolph St., Los Angeles 22, Calif.



## Photodrawings on CRONAFLEX®:

**Easy new way to communicate complex design data—  
at lower cost!**

Designing advanced computer prototypes, engineers at Remington Rand's Univac Division faced the problem of transmitting complex specifications to customers and production facilities—many of them overseas. Needed were drawings graphic enough to minimize misinterpretation, yet adaptable to progressive modification and refinement.

The solution: photodrawings on CRONAFLEX® Engineering Reproduction Films. In this technique, a photographic image is used as the main body of an engineering drawing and assembly detail is added by a draftsman. Not only does the new method make complicated specifications easily understandable, it has already cut drafting time—and costs—drastically.

Says Theodore Warzel, Chief of Univac Division's Photographic Department: "We actually turn out completed drawings about 25 times faster than we used to! And the excellent erasability of CRONAFLEX permits numerous revisions to be made—a must in critical development work—with no damage to its fine drafting surface."

Results like these are typical of the performance of CRONAFLEX in situations where other materials promote waste and inefficiency by failing to fit a need exactly. To learn how these versatile films can meet your own requirements, clip and mail the coupon today.

Draftsman adds assembly detail to complete master original photodrawing. Photographic images insure accurate interpretation of data, also mean tremendous savings in time and money.

E. I. du Pont de Nemours & Co. (Inc.)  
Photo Products Department DN 8  
Wilmington 98, Delaware

Please send me, without obligation:

- ☐ Information on the full line of CRONAFLEX films  
☐ Details on photodrawing technique described here

Name \_\_\_\_\_

Firm \_\_\_\_\_

Street \_\_\_\_\_

City \_\_\_\_\_ Zone \_\_\_\_\_ State \_\_\_\_\_



Better Things for Better Living  
... through Chemistry

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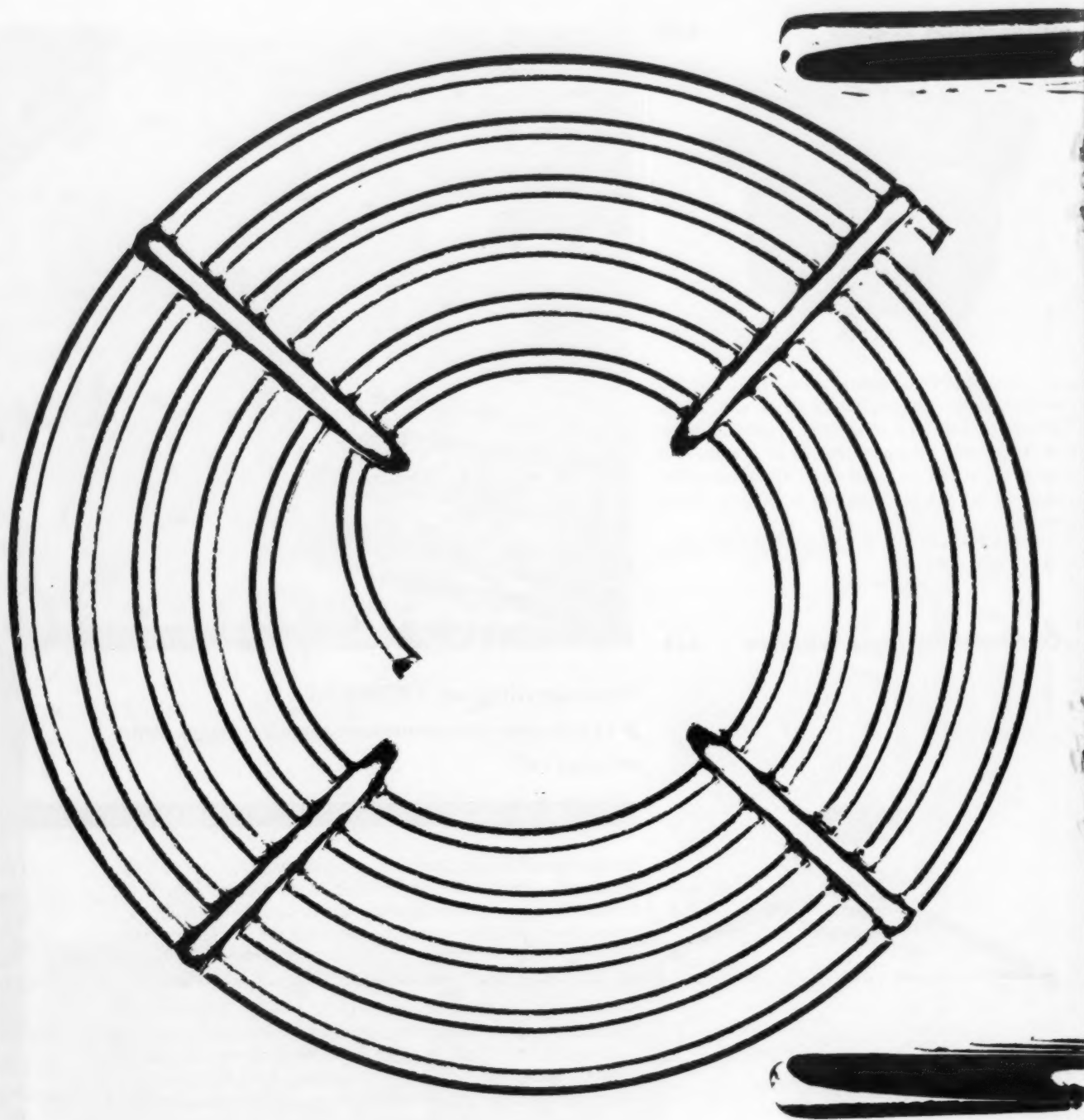
## ELECTRICAL

### 1KW Rectifier

322

This silicon bridge rectifier occupies just under 1/4 cu in but will supply 750 ma at 1400v d-c. The small rectifier has a 2000v peak inverse voltage rating and will operate from -55 to 150C. Applications include miniature high-output power supplies.

Varo, Inc., Special Products Div.,  
2201 Walnut St., Garland, Tex.





## Going round and round on product design? Do it with steel wire!

There is probably not a commercial photographer alive who is not familiar with the intriguing spiral object shown here. It's a developing reel that you load with exposed roll film for developing, fixing, and washing. The film spirals outward, and there is an even space between each layer to prevent uneven concentration of developer solution. This reel, designed and sold by the Nikor Corporation, Springfield, Mass., approaches perfect design: like a fine machine, it has absolutely no unnecessary parts. It is the most compact reel ever made. It is made from the best material to resist corrosive chemical attack: stainless steel. It is made from the strongest, most useful form of steel for this purpose: wire. Wire is cold drawn in successive passes through dies. This cold working imparts such a smooth surface finish that there is no danger of snagging the film on a tiny imperfection. The reel can be fabricated in jig time on high speed automatic wire forming machines, and because it's made from steel wire it can be permanently joined with one jolt from an automatic welder. There are dozens of film processing reels on the market but professionals continually buy this one because it has no equal. There are thousands of products that desperately need to be redesigned to retain their place in the market, and an untold number of these products could be drastically improved through the imaginative use of steel wire. Welded wire assemblies, for instance, are amazingly stiff and strong for their weight; and although this is a functional consideration, it has great meaning for the new aesthetics of design that is replacing ponderous and bulky products with those that are airy and graceful. Wire is manufactured to over 300 billet specifications, from low carbon through alloy to stainless steel grades. It is available in a vast range of hardness and sizes, as rounds, squares, or hexagons . . . in fact, more than 10,000 mill production specifications are available from American Steel and Wire. More than that, we can ship wire in carbon grades in 1,000 pound coils that do not contain a single weld, if required, American Steel and Wire, Rockefeller Building, Cleveland 13, Ohio.

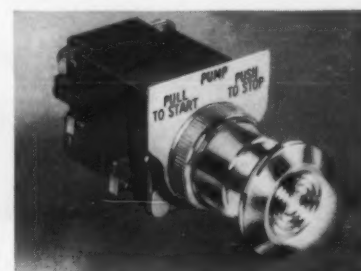
*Innovators in Wire*



**American Steel and Wire  
Division of  
United States Steel**

Circle 49 on Reader-Service Card for more information

## Illuminated Pushbutton 323

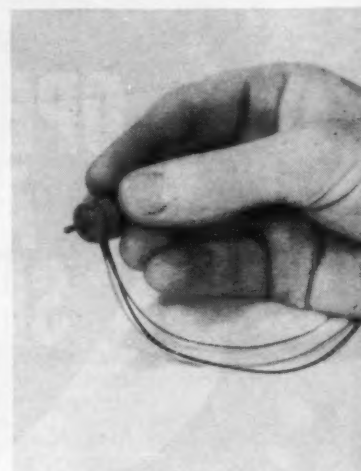


This "push-pull" switch contains its own pilot light. Designed for rapid one-hole mounting, this control contains a No. 51 6-8v lamp coupled with a builtin transformer. Models are available for either 115 or 230v with a variety of lenses in six different colors.

Mackworth G. Rees, Inc., 1573 E. Forest Ave., Detroit 7, Mich.

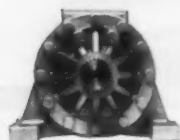
## Sine-Cosine Potentiometer

**324**



Available with a resistance range of 100 to 15,000 ohms, this single-turn sine-cosine potentiometer measures only 7/8 inch in dia. The new units are said to provide 1.2- to 0.2-deg angular resolution. In multiple gangs, the units will dissipate 1w per cup or 2w per cup in a single mounting. Applications include industrial controls and navigational equipment for missiles and aircraft.

Fairchild Controls Corp., 225 Park Ave., Hicksville, L. I., N. Y.



**A HYD-RO-AC HYDRAULIC ROTARY ACTUATOR** is used to open and shut this 18" W. S. Rockwell Butterfly Valve. The automatic two speed control is attached directly to the back of the actuator. Fast response and very smooth operation are attained at both operating speeds. Although this unit operates at 2,000 p.s.i. the HYD-RO-AC is designed to operate up to pressures of 3,000 p.s.i. Quality construction and low internal leakage mean low maintenance. Four sizes and 80 options are available off-the-shelf. Features include: torque ranges from 1,500 to 228,000 inch pounds at 3,000 p.s.i., travel to 280°, instantaneous torque in both directions, foot or end mountings. HYD-RO-ACs can perform an almost limitless number of functions. Can we show **you** how HYD-RO-AC can solve **your** hydraulic problems? Write us!



... Specialists in rotary type hydraulic equipment

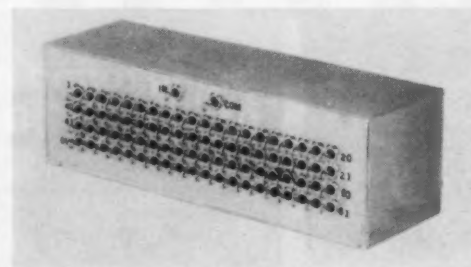
**Houdaille Industries, Inc.**

Buffalo Hydraulics Division • Dept. A • 537 E. Delavan Avenue, Buffalo 11, N. Y.

Circle 50 on Reader-Service Card for more information

## ELECTRICAL

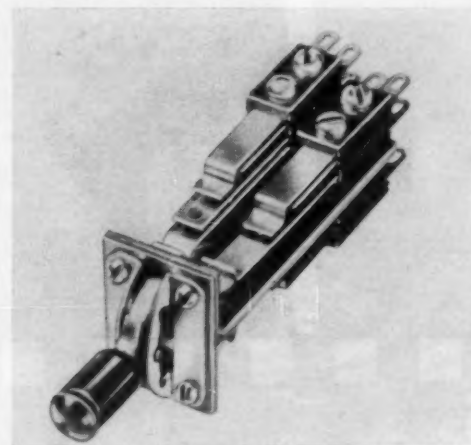
### Miniature Multitap Delay Line 325



Measuring only 1.5 inches square by 5 inches long, this delay line provides 80 taps in 0.050  $\mu$ second intervals to a maximum of 4  $\mu$ seconds delay. The Model DL 356, called a "porcupine" delay line, has an impedance of 100 ohms and 4 db maximum attenuation. The line is suggested for phasing the heads of multiple-channel tape recorders.

Valor Instruments, Inc., 13214 Crenshaw Blvd., Gardena, Calif.

### Locking Lever Switch 326



Designed to prevent accidental operation, this telephone-type lever switch locks in position. The locking is accomplished with an index bracket housed in the escutcheon plate and a release plunger. To lock, the actuator knob is turned to the extreme left; to release, the knob is turned to the right. The switch guards against unintentional operation resulting from shock vibration or operator fatigue. It can be supplied in standard circuits with both two-and three-position actuators, either locking or nonlocking.

Switchcraft, Inc., 5555 N. Elston Ave., Chicago 30, Ill.

## Lepel

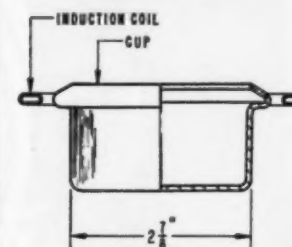
HIGH FREQUENCY  
Induction  
HEATING  
UNITS



Lepel induction heating equipment is the most practical and efficient source of heat developed for numerous industrial applications

### Typical Induction Heating Applications

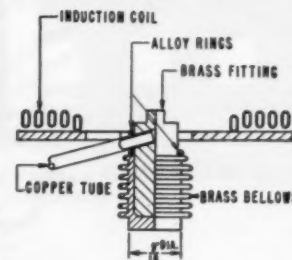
#### Stainless Steel Cups Selectively Annealed



Flanges of cups made from type 321 stainless steel are selectively annealed by induction heating prior to further forming. Flanges are heated to 2000° F and water quenched. Single-turn coil restricts heating to the flange area.

Our engineers will process your work samples and return the completed job with full data and recommendations without cost or obligation.

#### Bellows Assembly Brazed



Brass bellows and copper tube are simultaneously silver-alloy brazed to a brass fitting by induction heating. Plate-type induction coil produces proper temperature at each joint.

WRITE FOR NEW LEPEL CATALOG

**Lepel** HIGH FREQUENCY  
LABORATORIES, INC.

55th ST. & 37th AVE., WOODSIDE 77, N. Y.  
CHICAGO OFFICE: 6246 WEST NORTH AVE.

Circle 51 on Reader-Service Card

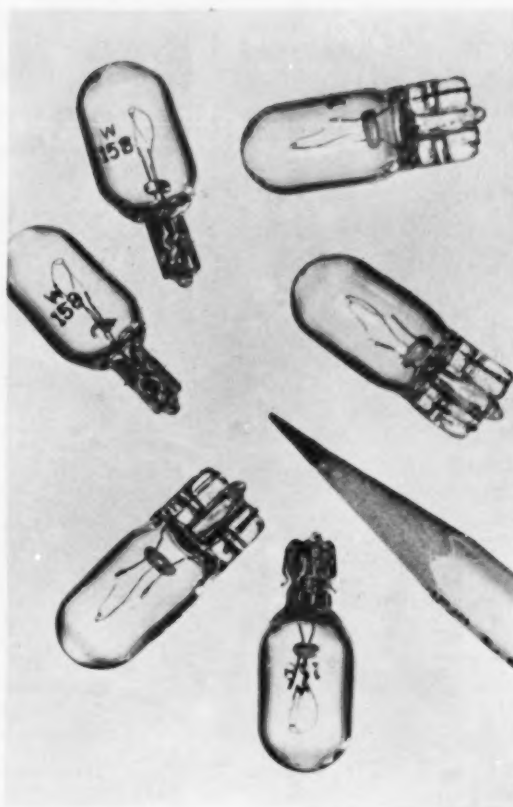


## Miniature Panel Bulb

327

A miniature light bulb, for use as an indicator lamp in panels and dashboards, is expected to find wide use in the automotive, aircraft and electronic industries. The compact bulb has no metal base or threads. Glass at the end of the bulb is formed into a flat wedge which is inserted easily into a simplified socket. The wedge-type bulb is merely pushed into the socket—no turning or twisting is necessary. Electrical contact is made by two tiny wires which are crimped into the recesses in the wedge base. Two types of wedge-based bulbs are available: a 12v bulb producing 2 candle power with a rated life of 500 hr; and a second 12v bulb producing 1 candle power with a rated life of 1500 hr.

Westinghouse Electric Corp.,  
Lamp Div., Bloomfield, N. J.



## SENSITIVITY UNEQUALED with $\Phi$ TORQMETERS



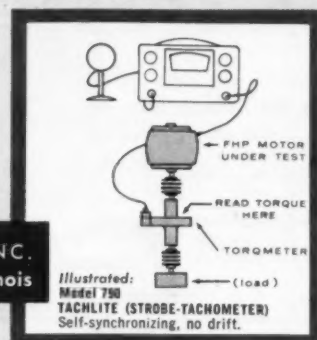
Illustrated:  
**Model 783 OZ-TORQMETER**  
measures from .05 to 80 oz.—inch  
Also available:  
**Model 782 GRAM-TORQMETER**  
measures from .25 gm-cm to 100 gm-cm  
**Model 784 POUND-TORQMETER**  
measures up to 200 lb.—inch  
**Model 781 GRAM-TORQMETER**  
measures from .05 gm-cm to 5 gm-cm

**POWER INSTRUMENTS, INC.**  
7352 North Lawndale Ave. • Skokie, Illinois

NOTE: A few choice territories available for experienced representation.

For ACCURATELY MEASURING Rotating and Static TORQUES of FHP motors, gear-train efficiencies, ball bearings, servos, synchros, potentiometers, hair springs, and many other applications and devices.

We invite your inquiry for complete information and prices... or, send your specifications and application needs.



Illustrated:  
**Model 790 TACH-LITE (STROBE-TACHOMETER)**  
Self-synchronizing, no drift.

Circle 52 on Reader-Service Card for more information



## have you met GRIPCO GUS ?...

If not, there are three reasons why meeting him could prove particularly profitable: (1) he's an expert fastener engineer with a penchant for solving problems; (2) he has 56 years' worth of fastener tricks up his sleeve; (3) his services are free and readily available right in your own backyard.

There are more than two score of "GRIPCO\* GUSes" serving friends and customers of the Grip Nut Company coast to coast. These are not just "nut hawkers." Each and every one is a trained technician first and a salesman second. As our only representatives, you can be sure they are hand-picked, heavily-trained, and fully equipped to serve your fastener needs with deference and dispatch.

You'll find your GRIPCO GUS listed (in the yellow pages) under Bolts & Nuts as the GRIPCO representative.

**GUS' GANG:** Toplock and Centerlock Nuts, Open and Closed End Cap Nuts, Clinch Nuts, Pilot-Projection Weld Nuts, Countersunk Weld Nuts, Tab Weld Nuts, Flange Nuts, Hex-Finished and Heavy Nuts, Washer Nuts, Self Piercing Clinch Nuts. Specials of every description, 20-page Catalog on request (see GUS).

\*GRIPCO is a registered trademark of Grip Nut Co.

**GRIP NUT COMPANY** | Subsidiary of Heli-Coil Corporation,  
Danbury, Conn.  
410 Maple Ave. • South Whitley, Ind. • Phone: South Whitley 723-5111

2994

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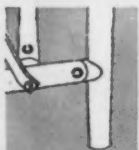
## Use it for laminating... SEL-LOK spring pin



Tool handle



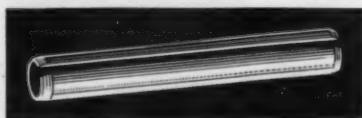
Lifts for women's shoes



Metal table legs

- Swift fastening—just drill and drive
- Secure locking—won't work loose despite shock or vibration
- Eliminates costly tapping, reaming, peening, milling
- Can be reused repeatedly
- 101 uses—as keys, cotter pins, axles, hinge pins, wrist pins, stop pins, pivots, etc.

SEL-LOK spring pins are available in carbon and corrosion-resistant steel (from  $\frac{1}{16}$  x  $\frac{3}{16}$  through  $\frac{1}{2}$  x 4 in.) and beryllium copper ( $\frac{1}{16}$  x  $\frac{3}{16}$  through  $\frac{1}{4}$  x  $3\frac{1}{2}$  in.). See your SPS distributor or write for Bulletin 2670.



INDUSTRIAL FASTENER Division

**SPS**

JENKINTOWN 6, PENNSYLVANIA

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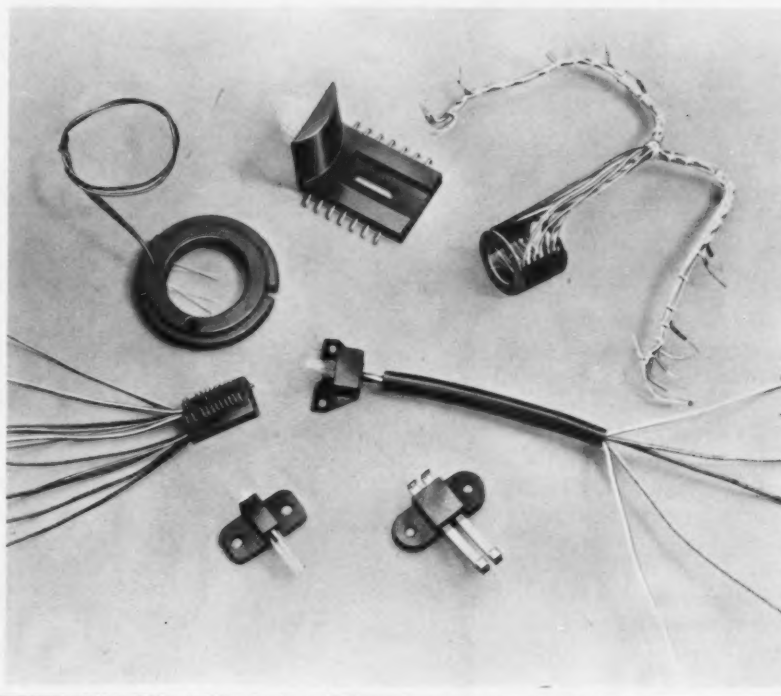
## MATERIALS

### Brush Blocks

328

Based on new materials of high stability, uniformity and consistency, Series 200 brush blocks are applicable to slip-ring assemblies from miniature to large power units. The materials used have a dielectric strength consistent up to 500v per millimeter. Other specifications include: dimensional stability to 400F with low coefficient of expansion; electrical stability consistently above  $10^{14}$  ohm-cm; high accuracy in brush positioning through material stability; inertness to corrosive atmospheres, and rigidity without sacrifice of impact strength.

Electro-Tec Corp., 10 Romanelli Ave., South Hackensack, N. J.



## RCA Selects *Simplatrol* Electric Clutch Brake CONSISTENCY — SMOOTHNESS — QUIETNESS

These are the reasons that R. C. A. engineers gave for selecting a Simplatrol CB-62 electric clutch-brake unit for use in its new electro-mechanical printer.

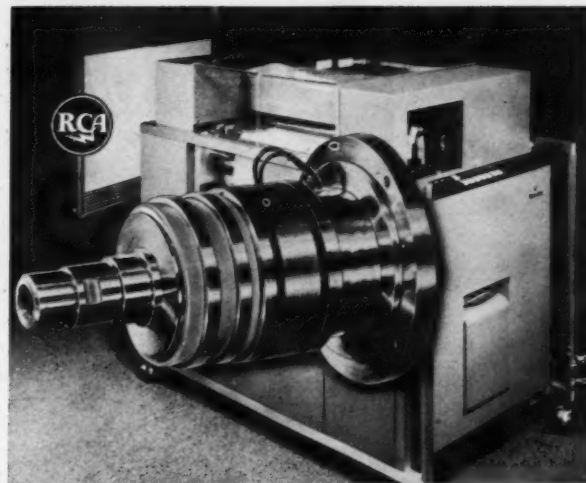
In this high speed application, the Simplatrol unit feeds the paper — and indexes it accurately for printing. Specially developed in cooperation with R. C. A. engineers, the Simplatrol unit gives "remarkable consistency".

In the tape drive section of the unit, the Simplatrol clutch-brake delivers a smoothness and quietness not previously available, and so necessary in business machines.

### The Simplatrol Diaphragm makes the Difference!

The only moving part in the Simplatrol clutch and brake operation is the patented diaphragm. Simplicity is the key-note and the basis of the success of these performance-proved clutches and brakes.

Ask for Simplatrol literature on miniature and small, fixed field and larger sizes electric clutches and brakes. Ask also for data on adaptation of Simplatrol clutches and brakes to your special requirements.



R.C.A. 801 Data Processing System — Electro-mechanical Printer

***Simplatrol* products corp.**  
24-3 SALISBURY ST., WORCESTER, MASS.  
Representation in Key Industrial Areas

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looking  
for  
**STRONG**  
and  
economical  
**CHAIN?**



**LOCKE**  
STEEL  
PINTLE  
CHAIN

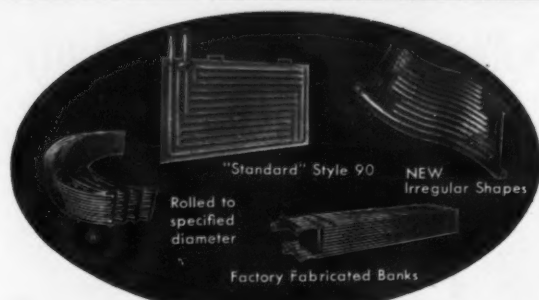
THE LOCKE STEEL  
CHAIN COMPANY  
HUNTINGTON, IND.

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## PLATECOIL®

FOR ALL KINDS OF TANK AND PROCESS HEATING AND COOLING

- Built to fit application requirements
- High heat transfer capacity
- Compact units save space
- Easy to install
- Easy to remove for cleaning
- Available in variety of weldable metals
- Operating Pressures up to 250 psig.



"Platecoil" can be furnished to comply with ASME code

Send for  
Bulletin PSI



TRANTRER MANUFACTURING, Inc., LANSING 9, MICHIGAN  
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## Does R & D on Your Product Involve Bearing Problems?



Write for McGill  
Brochure No. 660,  
a bulletin of facilities  
and abilities. It explains how we can help you on  
your bearing application problems in the early stages of  
product research and development.



McGILL MFG. CO., Bearing Div., 203 N. LAFAYETTE ST., VALPARAISO, IND.  
Circle 58 on Reader-Service Card for more information

## Solid Lubricant 329

Applications for this grease-type material include lubrication of heavy machine ways and guides, prevention of galling and seizing in threaded connections, reduction of cam wear, reduction of metal pickup on lathe centers and steady rests, press-fitting of bearings and gears on shafts, and prevention of fretting on splines. The material contains a high concentration of molybdenum disulfide, an effective lubricant for extreme-pressure applications. "Molykote G" is packaged in 7/10- and 2-oz tubes; 12-oz jars; 1-, 4- and 15-lb cans, and 50-lb drums.

Alpha-Molykote Corp., 65  
Harvard Ave., Stamford,  
Conn.

## Fluoro- Elastomer 330

"Fluran F-5000" has an operating temperature range from 400F in continuous service to 600F in intermittent use. Low-temperature brittle point is near -40F. The material has a broad range of resistance to corrosive chemicals, fuels and lubricants. Parts made of Fluran F-5000 afford resistance to oxidation and weathering. The elastomer can be supplied in hardnesses from 60 to 95 durometer on the Shore A scale. At room temperature, tensile strength ranges from 2000 to 3000 psi and elongation varies from 100 to 400 percent. When held compressed for 70 hr at 250F, the material recovers to within 90 to 97 percent of its original dimensions. Tubing, hose, press polished sheets or die cut and clicked gaskets can be supplied to customer specification.

U. S. Stoneware, Plastics & Synthetics Div., Akron 9, Ohio.



*W/L on target!*

## New METOHM line exceeds MIL-R-10509D

As a supplement to the unexcelled VITROHM resistors, Ward Leonard now offers to designers of commercial, military and industrial electronic equipment a line of molded metal film precision resistors, designed and tested to exceed the requirements of MIL-R-10509D, characteristics B, C and E. You can stake your reputation on Ward Leonard resistors.

Available in 1/8, 1/4 and 1/2 watt sizes, W/L METOHM precision resistors feature the highest degree of built-in reliability and operating stability. Temperature coefficients, over the range -55°C to +175°C, may be as low as ±25 parts per million. Standard tolerance ±1%. Tolerances down to ±0.1% on special order.

METOHM TYPE	MIL EQUIVALENT	RATED WATTS	OHMIC VALUES		MAX. VOLTAGE RATING
			MIN.	MAX.	
WL 60	RN 60	1/8	30	500K	250 V.
WL 65	RN 65	1/4	50	1 meg.	300 V.
WL 70	RN 70	1/2	50	1.5 meg.	350 V.

Write for complete specifications and a list of distributors. Ward Leonard Electric Co., 26 South Street, Mount Vernon, New York.

Q.10



RESULT-ENGINEERED CONTROLS

# WARD LEONARD ELECTRIC CO.

MOUNT VERNON  
NEW YORK

RESISTORS • RHEOSTATS • RELAYS • CONTROLS • DIMMERS

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### Molding Compounds 331

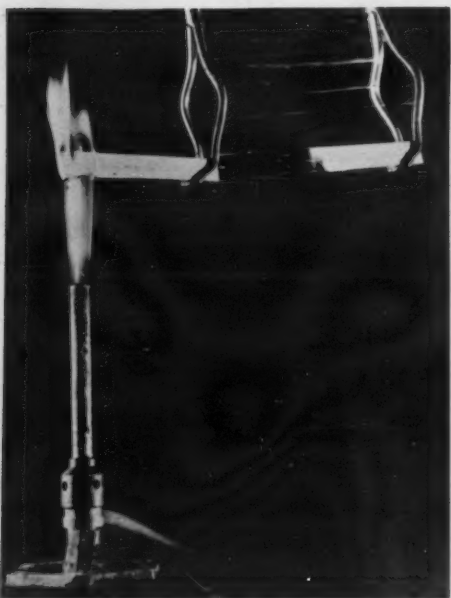
Two new compounds have been developed—made of fiberglass-reinforced polyester—for molding electrical parts. Grade 1706 features high dielectric plus high impact strength, good thermal stability and high corona starting voltages. Flexural strength is 20,000 psi and tensile strength is 6000 psi. Tan in color, the material has a shelf life of 60 days at 85F. The flame-retardant Grade 1504 may be obtained in gray or black and has a similar shelf life. Its flexural strength is 10,000 psi and compressive strength is 15,000 psi. Samples of both materials are available.

Glastic Corp., Molding Materials Div., 4321 Glenridge Rd., Cleveland 21, Ohio.

### Flexible Flame-Out Compound 332

Here is a casting compound which does not support flame and is also flexible. The two-part resin has a cured density of 0.06 lb per cu in and is green in color. At 25C, pot life is two to three days, while cure is 4 hr at 125C. While this flexible flame-out casting compound originally was designed for encapsulating transformers, it is equally suitable for other electronic components. It has good electrical and physical values and passes the thermal shock washer test and ASTM D635-56T test on self-extinguishing capabilities.

Hysol Corp., Olean, N. Y.



# 4 REASONS WHY HELP YOU BUILD LONGER

*Versatile Du Pont Elastomer Assures Greater Reliability,*



## 1. HYPALON Is Ozone-Proof

No other rubber can match it. Drain hoses above were exposed simultaneously to 15 PPM ozone for more than 5 hours under lab test conditions. Ordinary rubber hose (bottom) developed severe cracks, split when bent. HYPALON-veneered hose (top) remained tough, lively, crack-free.

HYPALON's outstanding combination of properties—not offered by *any* conventional synthetic rubber—makes it an ideal material for “service free” appliance design. HYPALON has proven especially successful in applications where severe operating conditions shorten the life of ordinary rubber parts.

Exceptional resistance to ozone, flame, abrasion and chemicals, plus *permanent* colorability, are just a few of the reasons why HYPALON is specified for key resilient components by many leading appliance manufacturers. There are others—such as excellent resistance to temperature



## 2. HYPALON Is Flame-Resistant

Gives appliances an important safety bonus because it will not support combustion. In a test exposure to open flame, HYPALON door seal (left) extinguished itself as soon as flame was removed. Seal made of ordinary synthetic rubber, however, continued burning.

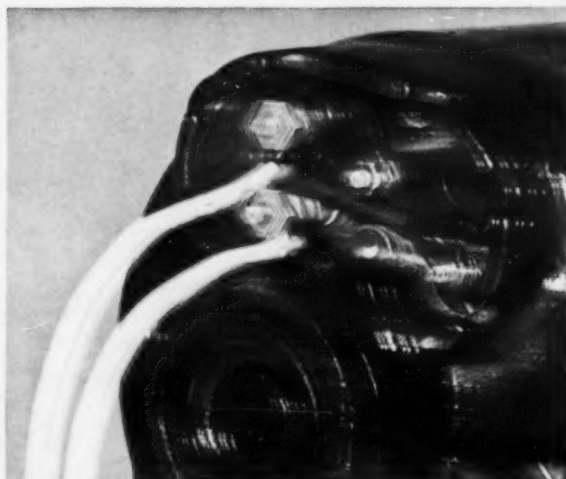
extremes and good electrical characteristics. HYPALON is currently lengthening the life of such parts as bleach tubing, drain hose, seals, gaskets, electrical wire and other resilient molded and extruded parts.

Investigate the design advantages of HYPALON in the appliances *you* design and manufacture. For detailed information, send for our free booklet discussing properties and applications. Clip and mail the handy coupon today. Or just write: E. I. du Pont de Nemours & Co. (Inc.), Elastomer Chemicals Department DN-10, Wilmington 98, Delaware.



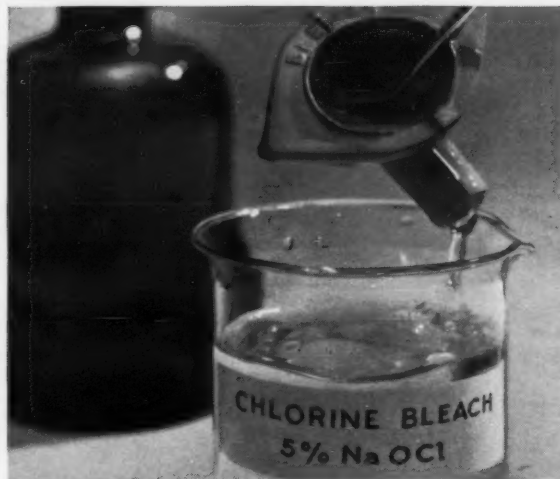
# HYPALON® CAN SERVICE INTO APPLIANCES

*Prevents Breakdown of Key Resilient Parts. Here's Why:*



## 3. HYPALON Is Durable

Parts stay tough and lively, afford long, reliable service because of excellent resistance to abrasion, flex-cracking, extremes of temperature. HYPALON is ideal for lead wires on motors and compressors where exposure to constant vibration, ozone, heat, oil and grease is common.



## 4. HYPALON Resists Oils and Chemicals

Outstanding resistance to strong oxidizing chemicals suits HYPALON for prolonged contact with concentrated bleach solutions. HYPALON resists dyes, wet steam, household ammonia, detergent-laden wash water... performs well in contact with food chemicals, lubricating oils, many solvents.

## AND... HYPALON Is Color Stable

Can be compounded in white and an unlimited array of bright and pastel shades to complement appliance styling, enhance sales appeal. Colors are stable and durable, stay bright and fresh. Even weather and sunlight won't cause them to fade or darken.



BETTER THINGS FOR BETTER LIVING  
... THROUGH CHEMISTRY

**HYPALON®**  
SYNTHETIC RUBBER

**E. I. du Pont de Nemours & Co. (Inc.)**  
Elastomer Chemicals Department DN-10  
Wilmington 98, Delaware

Please send me, without obligation, more information on Du Pont HYPALON synthetic rubber.

Name

Firm

Address

City  Zone  State

## Adhesives for Plastics

333

These new adhesives are made from a water-based latex polymer and are designed for adhering unsupported plastics to cotton, wood, leather, acetate, "Mylar" and polyurethane foams. Called "Plastix Wet Stick" and "Plastix Heat Seal", the adhesives may be applied by roller coater, spray, brush and in heavier viscosities for doctor blade applications. The material may be used for flocking on vinyl or other plastics and can be used for thin-gage plastics without wrinkling. Materials may be precoated with "Heat Seal", allowed to dry, then stacked or die-cut for heat-sealing at a later date. A strong, permanently flexible bond is formed instantaneously when heat is applied.

Adhesive Products Corp., 1660 Boone Ave., New York 60, N. Y.

## RF Shield and Gasket

334

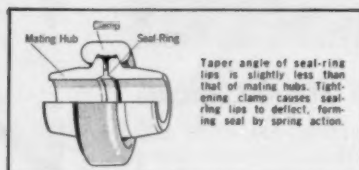
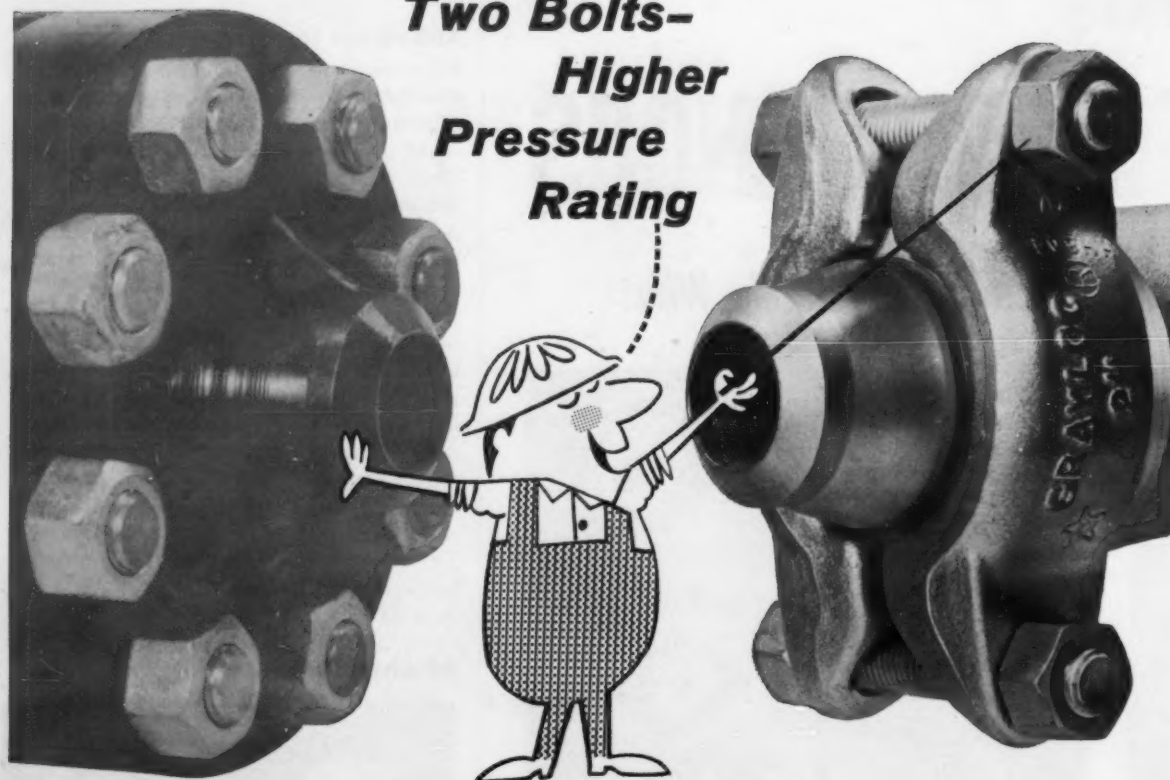


A gasket material which seals fluid and also prevents radio-frequency interference can be supplied with complex shapes and in almost any size. The material, measuring 0.02 inch thick, is said to provide a shielding effectiveness of 75 to 100 db. Neoprene or silicone impregnated, a pressure-tight fluid seal is provided. The "Duolastic" gasket material is useful in applications where space does not permit both radio-frequency interference and fluid seal.

Technical Wire Products, Inc., 129 Dermody St., Cranford, N. J.

Circle 60 on Reader-Service Card for more information

**Only  
Two Bolts—  
Higher  
Pressure  
Rating**



GRAYLOC® Pipe Connections can be assembled in less than 1/3 the time required for a comparable flanged assembly — yet GRAYLOC Connections provide as much as twice the maximum pressure rating.

An all steel assembly, GRAYLOC incorporates a pressure aided seal that can be quickly and easily disconnected — the seal ring is completely re-usable. GRAYLOC connections are smaller in size and lighter in weight than any other comparably rated connection.

GRAYLOC Connections are manufactured in standard stock sizes from 1" to 30", with special sizes available on request. Highly corrosion resistant metals are available on short notice.

GRAYLOC Pipe Connections can save you assembly and maintenance time, space and money. Write today for specific engineering information and your copy of the new GRAYLOC catalog.

GRAYLOC SALES DIVISION  
**GRAY** *Tool Company*

P. O. BOX 2291 • HOUSTON 1, TEXAS • Riverside 7-1240

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**EQUIPMENT**

**Traction Dynamometer**

**335**

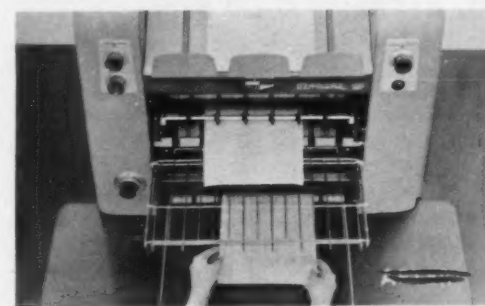


Model TD finds applications in measuring static and dynamic loads in tension, compression, weight, torque and traction. It may be used in wire-pulling, adjusting of support cables and guy wires, determination of draw-bar pull, weighing of loads suspended from hoists and in various test jigs. Range is from 500 to 20,000 lb and the instrument is accurate to 1 percent of capacity. The rugged device is not harmed by suddenly applied or released loads. It is rubber-gasketed for protection against climate and dust, is corrosion resistant, has shatterproof glass and conforms to federal specifications. Maximum indicating pointer and 10-percent tare adjustment are included.

John Chatillon & Sons, 85 Cliff St., New York 38, N. Y.

**Duplicating Machine Tray**

**336**



Designed for the manufacturer's "Ozalid" office duplicating machine, an adjustable welded-wire paper-receiving tray is lighter in weight than a fixed sheet steel unit. The welded-wire part is adjustable in depth from 10-1/4 to 12-1/4 inches to receive 10- or 12-inch sheets of paper. Tray attaches to machine with two small studs. Fabricated of 3/16- and 1/8-inch steel wire, the corrosion-resistant unit allows sheets to be removed easily and permits the operator to see through to the paper-feed unit.

General Aniline & Film Corp., Ozalid Div., Binghamton, N. Y.

## Hot-Air Blower

337

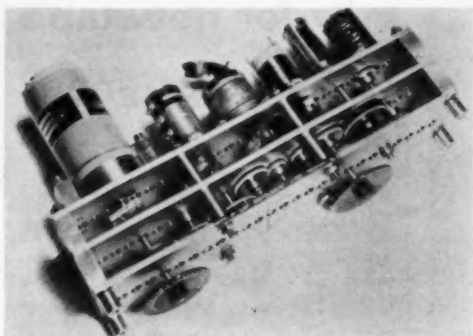


This hand-held hot-air blower provides temperatures up to 1000F at 3000 fpm from a 1-1/2-inch-dia nozzle. Fitted with a pistol grip and weighing approximately 4 lb, the blower operates on standard 115v a-c with fused protection and also can be furnished for 220v a-c. The unit may be used for some types of molding, welding, fusing, heat-sealing and soldering as well as drying, thawing frozen parts and for softening modern thermoplastic materials.

Milwaukee Lock & Mfg. Co., 5068 N. 37th St., Milwaukee 9, Wis.

## Gear Train System

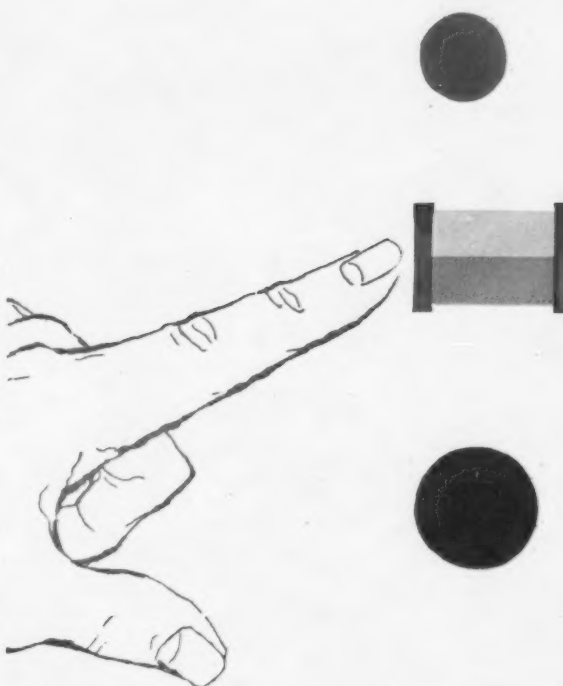
338



Typical of a new line of gear trains is the unit illustrated. The system features "straight line" assembly. A "Mark 14" servomotor is geared 22:1 to a Size 10 mechanical stop through an adjustable slip clutch, a Size 11 synchro and dial, a Size 15 synchro, a Size 9 potentiometer and dial and a Size 23 resolver. Synchros or potentiometers may be removed from the system without destroying gear train synchronism. Stocked plates are all 2-3/16 inches wide and come in various lengths to 11-5/8 inches. The unit measures 2-1/4 inches high by 11-1/2 inches wide by 7-3/4 inches deep. Complete gear train, including assembly, is constructed with use of customer-furnished rotating electrical components.

Gap Instrument Corp., 116 E. Merrick Rd., Freeport, N. Y.

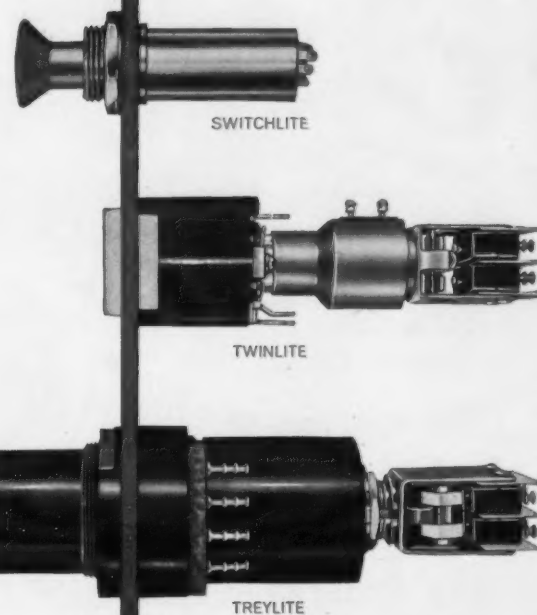
## CUT CONTROL PANEL COSTS AND SAVE SPACE WITH COMBINED SIGNAL & SWITCH



The most modern control panel designs combine indicator lights and pushbutton switches wherever possible.

This cuts costs by reducing the number of components, and speeds assembly. Overall panel size can often be reduced as much as 75%. And these "human-engineered" controls sell better because operation is obviously simplified. Here are just three of the many lighted pushbuttons available from Control Switch Division...

Engineers and Technicians: check with Control Switch about challenging career opportunities.



**SWITLITE** Model J8003 shown is a single lamp, D.P.D.T., push-push. Independent lamp circuit for 6, 14 or 28 volts. Rated 3 amp res., 1 amp ind. @ 28 VDC or 115 VAC. Mounts in 1/2" dia. hole. 4 button styles, several lens colors.

**TWINLITE** . . . two lamps with independent circuits for 2-color lighting. Lens 1" x .740" in solid or split colors, with or without nameplate slot. Momentary or push-push action, or solenoid-held switch shown above. Rated 4 amp res., 2.5 amp ind. @ 30 VDC; 5 amp @ 125/250 VAC. Mount in groups or singly, using barriers.

**TREYLITE** . . . three independent lamps, each with color filter so three colors can be sequenced on white pushbutton screen. D.P.D.T. switch rated 4 amp res., 2.5 amp ind. @ 30 VDC; 5 amp @ 125/250 VAC. Select momentary or push-push action. Models for flush-panel mounting (shown above) or sub-panel mounting.

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CONTROL SWITCH DIVISION

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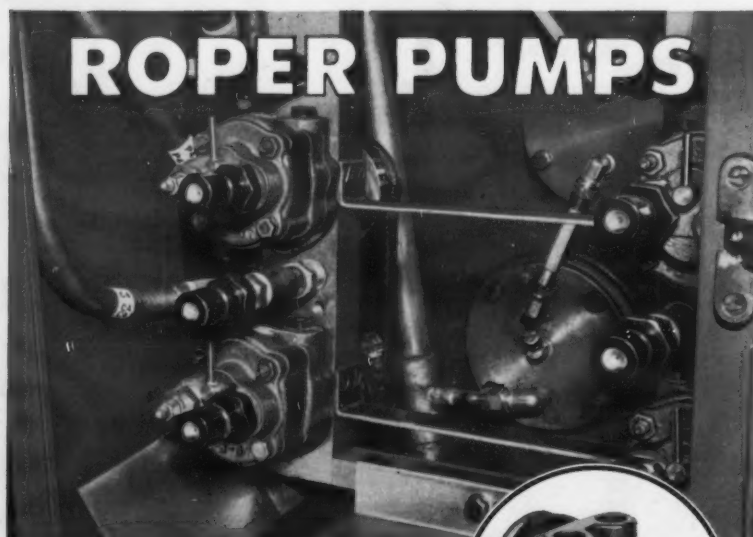


Photo courtesy R. Hoe & Co., Inc.

### SERIES K FIGURE 17K3

## dispense inks to individual rollers on high-speed press

• SERIES K SIZES: ¼-110 GPM

• PRESSURES TO 400 PSI

This Colormatic printing press, manufactured by R. Hoe & Co., Inc., is equipped to print multi-colored inks at one press run. These inks range as high as 10,000 SSU in viscosity, and are dispensed to individual rollers at 1½ gpm under 20 psi pressure by custom-modified Roper Fig. 17K3 pumps. The four pumps on each press are manually switched into operation and are belt-driven. Valving arrangement on the pumps allows the pressman to switch from ink to solvents when cleaning the press rollers. Series K pumps are adaptable to a wide range of jobs, such as pressure lubrication, hydraulic service, fuel supply, or general transfer work. They are self-priming, and operate with equal efficiency in either direction of rotation.

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**ROPER**  
**HYDRAULICS, INC.**

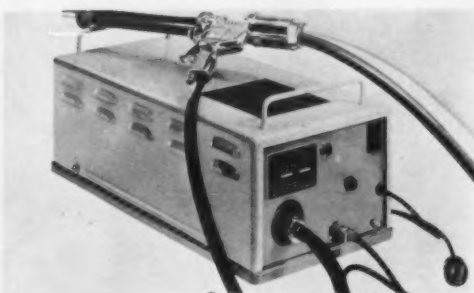
Dependable pumps  
since 1857  
COMMERCE, GEORGIA

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## EQUIPMENT

### Electrostatic Spray Gun

339

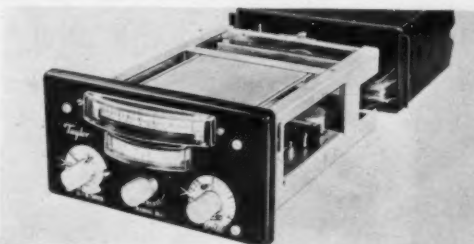


The use of an antisparking head made with semiconducting elements provides the safety necessary to work with burnable powders. The electrostatic spray gun electrically charges a fine powder, which then is directed to and evenly deposited upon any object within the influence of the electric field. Since the charged particles all are deposited, there is no coating wasted. Called the "Stajet", the equipment consists of an electrostatic generator delivering 90,000v at a current up to 0.2 ma, a spray gun with an antisparking head and a powder reservoir.

SAMES, 30 Broad St., New York, N. Y.

### Electronic Control Stations

340



Series 701K feature large, full-scale, process indication and a complete manual power supply. Compact design and front-panel switching allow the units to be mounted in limited space. The 3-inch process meter and 2-inch output meter are centered on front panel and calibration of both meters is based on 1-5 ma d-c. A multi-position switch permits automatic or manual control modes and balances the operational amplifier. The fourth position of the switch allows adjustments for a bumpless transfer from automatic to manual. Included in optional features are a 1-percent process indication meter, control point detection and a manual loading station. A nonindicating type (Series 701N) without the process meter is also available.

Taylor Instrument Companies, 95 Ames St., Rochester 1, N. Y.

# NASHUA approves high starting torque of HEINZE SMR MOTORS

for new tape  
dispenser



Nashua Corporation's Vuematic tape dispenser which provides ready-to-use high quality sealing tape in positive lengths, relies on a motor with high starting torque. The Heinze SMR Universal Motor supplies this — plus long life. External brushes are easily accessible. Company executives state, "Our people in service, manufacturing and sales all endorse these fine motors which have been used by us for several trouble-free years of operation." Heinze Universal Motors are compact, have high starting and running torques, are versatile to allow all types of mounting arrangements and modifications, are uniform in quality, keyed to high production, and are competitively priced.

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**HEINZE**

**ELECTRIC COMPANY**  
695 Lawrence St., Lowell, Mass.

ONE-FRAC-TIONAL HORSEPOWER MOTORS AND BLOWERS

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DESIGN NEWS—OCTOBER 27, 1961

## Sling Automatic

341



Here is a self-releasing choker hook which allows the automatic unloading of the sling, eliminating the need of a rigger when removing loads. The device consists of a metal mesh cloth with sliding choker and handle at the end of the sling. When the sling is loaded, tension holds the choker hook in an upright position. When the load is lowered, tension caused by the weight of the load is removed, allowing the arm of the choker hook to fall, disengaging the sling handle. A metal pin through the fabric of the sling prevents the choker from falling to the sling handle as it is raised.

Cambridge Wire Cloth Co.,  
Cambridge, Md.

## Stereo Phase Checker

342

Loudspeaker phasing of stereo systems is checked with this sound-powered device requiring no transistors, tubes or batteries. The WG-360A consists of two separate receptor units, each containing a 4-inch, high-sensitivity, permanent-magnet speaker. One unit is provided with a 15-ft double-conductor lead terminated with a plug fitting a receptacle at the back of the second unit. The device is designed for use with any conventional VOM, vacuum-tube voltmeter or oscilloscope. Both the receptors are housed in smooth, fabric-covered, wooden cases.

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## DESIGN DESIGN IDEAS NEWS

### Truck Uses High-Tensile Frame to Carry 95-Ton Load

Lars G. Soderholm, Midwest Editor

A 300,000-lb end dump truck uses high-tensile frame side rails bolted together with high-strength bearing bolts. The tractor-trailer combination is joined by a spherical ball-bushed, free-oscillating, universal-type trailer hitch.

To obtain greater payload, the design engineers made use of pressed frame rails of a high-strength, heat-treated alloy steel. With this type of construction, rail sections could be controlled so the deepest sections (and greatest strength) are placed where most needed. Individual frame rails are symmetrical from end-to-end and are bolted together with high-strength bearing bolts in a back-to-back-type construction. Bolted construction prevents the annealing and loss of strength the metal would experience if welded. By using alloy-steel frame rails, a saving in weight of more than 50 percent was realized over previous methods of construction.

The special trailer hitch permits rotation in three planes to compensate for variations in alignment between tractor and trailer units. Self-aligning ball bushings are used at all three pivot points to eliminate the necessity of holding extremely accurate boring tolerances and to ease parts assembly.

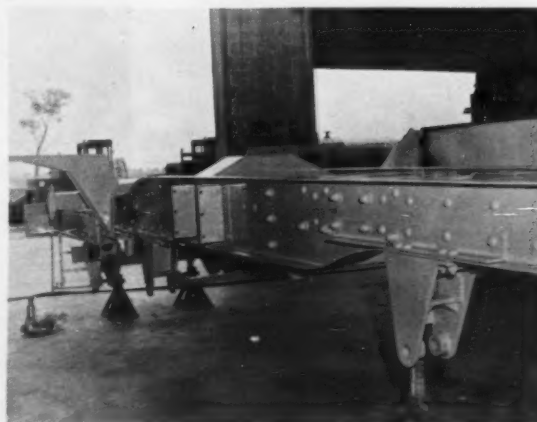
Other interesting design features include the bridge truss-type construction for body side members. This provides necessary strength to support the load and also a low center of gravity for greater vehicle stability. The air tanks, which normally consist of three separate units, are integrated in the form of a single tank with separate chambers in each dished section.

This huge truck is powered by a 1710-cu-in, V-12 turbo-diesel engine that develops 700 hp at 2100 rpm. It has a new 140,000-lb-capacity planetary drive axle, a 140,000-lb trailer axle and a conventional steering front axle. The eight 2100-35 tires on the dual rear and trailer wheels and the two 1800-33 front tires determine the 300,000-lb gross vehicle weight. The truck's axle capacity was intentionally designed to be greater. The cooling system uses 73 gal of water and the radiator is designed to take care of approximately 2,418,000 Btu per hr.

The 95-EDT tractor-trailer combination unit is manufactured by the KW-Dart Truck Co., Kansas City, Mo.



**HITCH ASSEMBLY** utilizes yoke which permits three planes of rotation between tractor and trailer units. Each pivot uses ball bushing to eliminate costly high machining tolerances for interconnected bearings.

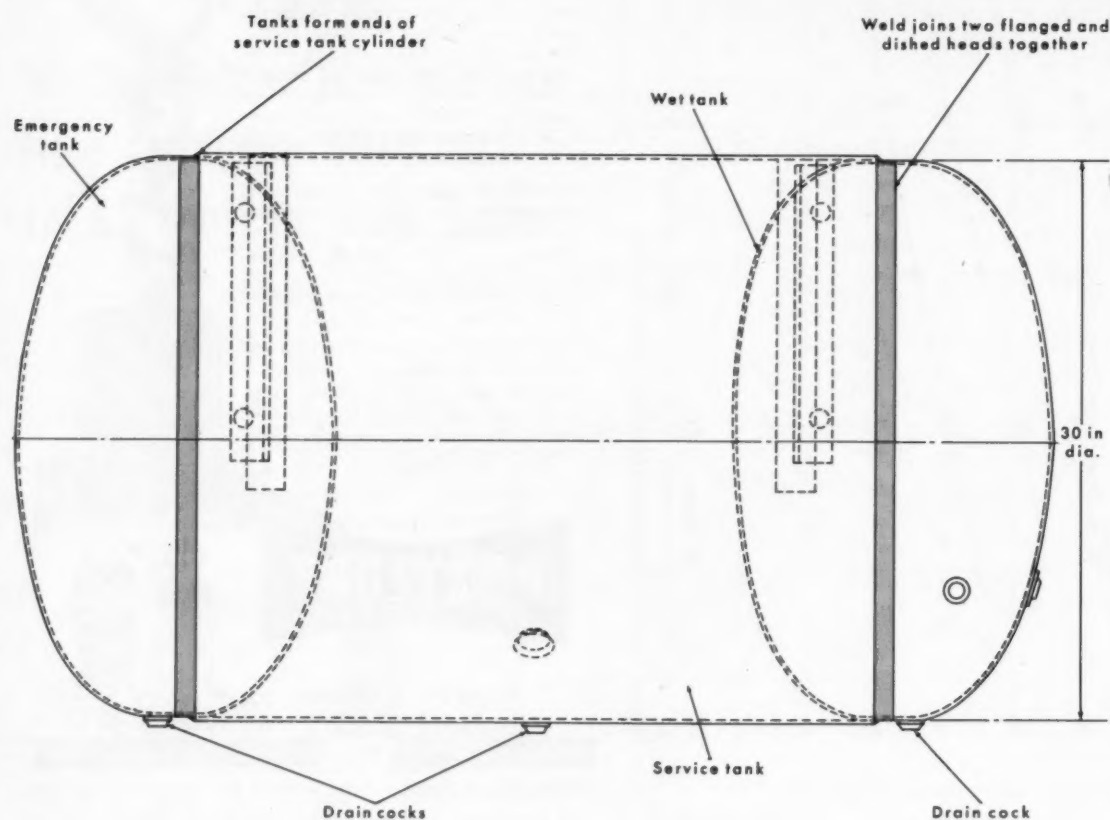
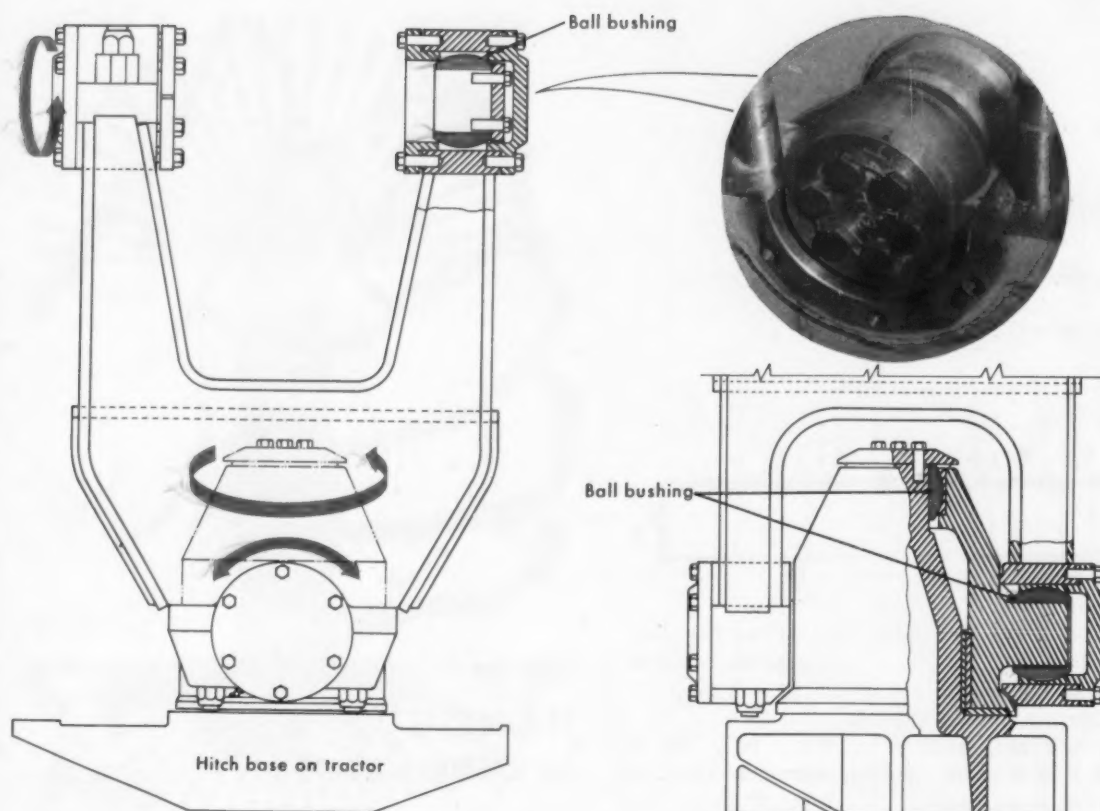


**BOLTED FRAME RAILS** consist of pressed sections of 120,000-psi high-strength alloy steel mounted back-to-back and fastened together with "corn cob"-type high-strength bearing bolts. Frame rail construction resulted in high strength-to-weight ratio.

**AIR TANK** uses integrated construction to secure space for wet tank and emergency tank within service tank. Two dished heads are welded together to form both wet and emergency tanks. These are used to close ends of metal cylinder that becomes service tank.

Circle 66 on Reader-Service Card for more information

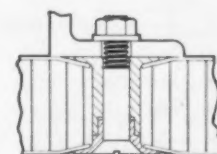




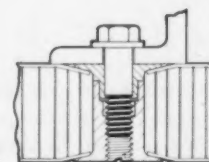
# HONEYCOMB and sandwich panel FASTENERS

PATENT PENDING

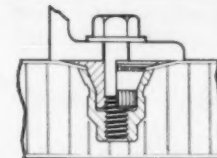
by **Delron**



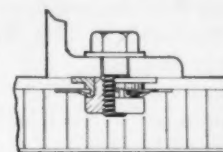
**GROMMET FASTENER**  
Series 101 and 102  
Thru-Rivet and Thru-Bolt Type



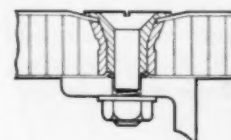
**GROMMET FASTENER**  
Series 103  
Series 104 (Self-Locking)



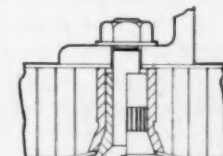
**BLIND FASTENER**  
Series 293  
Internal Thread Blind Type



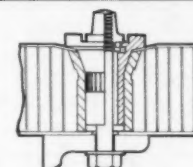
**BLIND FASTENER**  
Series 293K  
Threaded Clinch Type



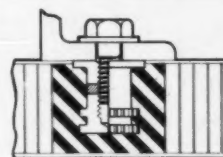
**STRUCTURAL FASTENER**  
Series 600 Flared  
Thru-Rivet and Thru-Bolt Type



**STRUCTURAL FASTENER**  
Series 600 Regular  
Thru-Rivet and Thru-Bolt Type

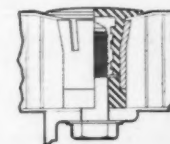


**STRUCTURAL FASTENER**  
Series 700  
Floating Locknut Type



**MOLDED-IN INSERT**  
Series 404H  
Blind Molded-in Type

Illustrated are only a few of the many available types of Delron Sandwich Panel Fasteners. Write for complete Technical Data.



**STRUCTURAL PLASTIC FASTENER**  
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## Maximum Moment

### Two Equal, Concentrated, Moving Loads

S. Warren Kaye, Peabody, Mass.

Moving loads, for the most part, are those which move under their own power and may be moved from one position to another on a structure. They either can be applied gradually without impact or rapidly, thereby exerting an impact effect on the structure. When moving loads are involved, it is necessary to compute the maximum moment caused by these loads so that the structure may be adequately designed.

Maximum moment =  $P/2 (L - a + a^2/4L)$   
When:  $a$  is less than  $0.586L$ .

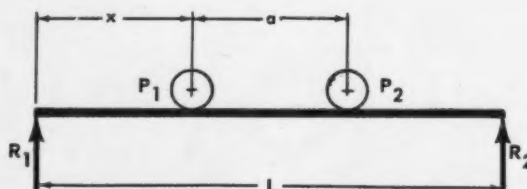
Where:

$P_1 = P_2$  = concentrated moving load, lb

$a$  = distance between the two equal concentrated loads, inches or ft.

$L$  = length of beam, inches or ft.

Example 1: A 10-ft beam is subjected to two equal moving loads  $P_1 = P_2 = 100$  lb. If the distance  $a$  between loads is 3 ft, find the maximum mo-

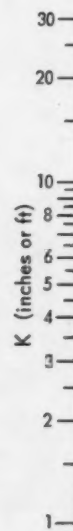
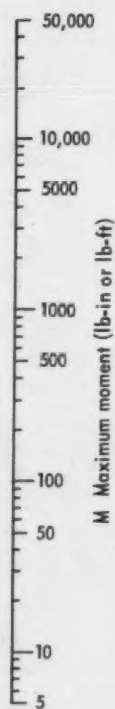
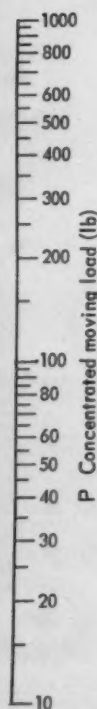


ment.

Solution: 3 ft is less than  $0.586L$ . From the chart for  $L = 10$  ft and  $a = 3$  ft, read  $K = 7.2$  ft. On the nomogram, align  $P = 100$  with  $K = 7.2$ , intersecting  $M = 360$  lb-ft.

Example 2: If  $L = 30$  inches,  $P_1 = P_2 = 600$  lb, and  $a = 9$  inches, find the maximum moment.

Solution: From the chart, for  $L = 30$  inches and  $a = 9$  inches,  $K = 21.7$  inches. On the nomogram, align  $P = 300$  with  $K = 21.7$ , intersecting  $M = 6500$  lb-in.



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POXYLUBE has saved time, money and effort for others... now let it work for you. POXYLUBE 750 (heat cure) and POXYLUBE 420 (air dry) available in economical bulk quantities or aerosol spray cans.

POXYLUBE

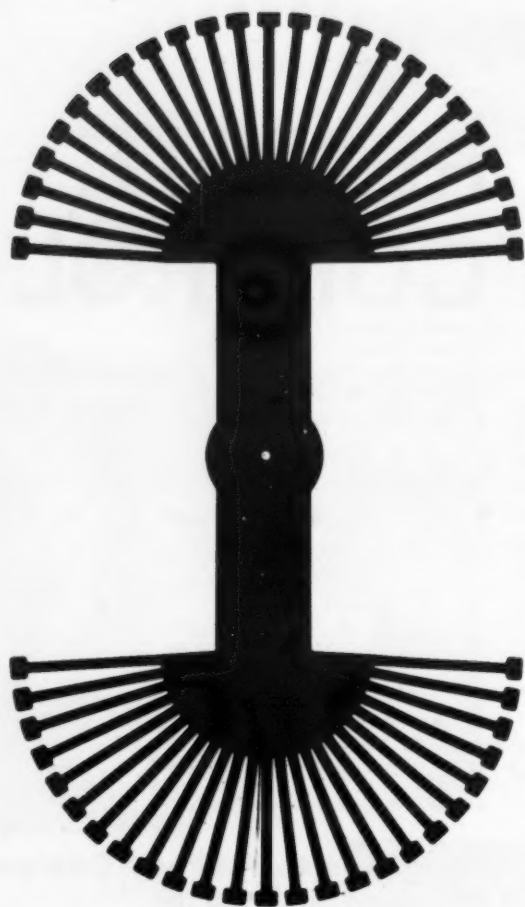


POXYLUBE 750 (Heat Cure): \$4.25 e.  
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POXYLUBE, INC., Dept. DN2, 541 S. Webster, Indianapolis 19, Ind.

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DESIGN NEWS—OCTOBER 27, 1961



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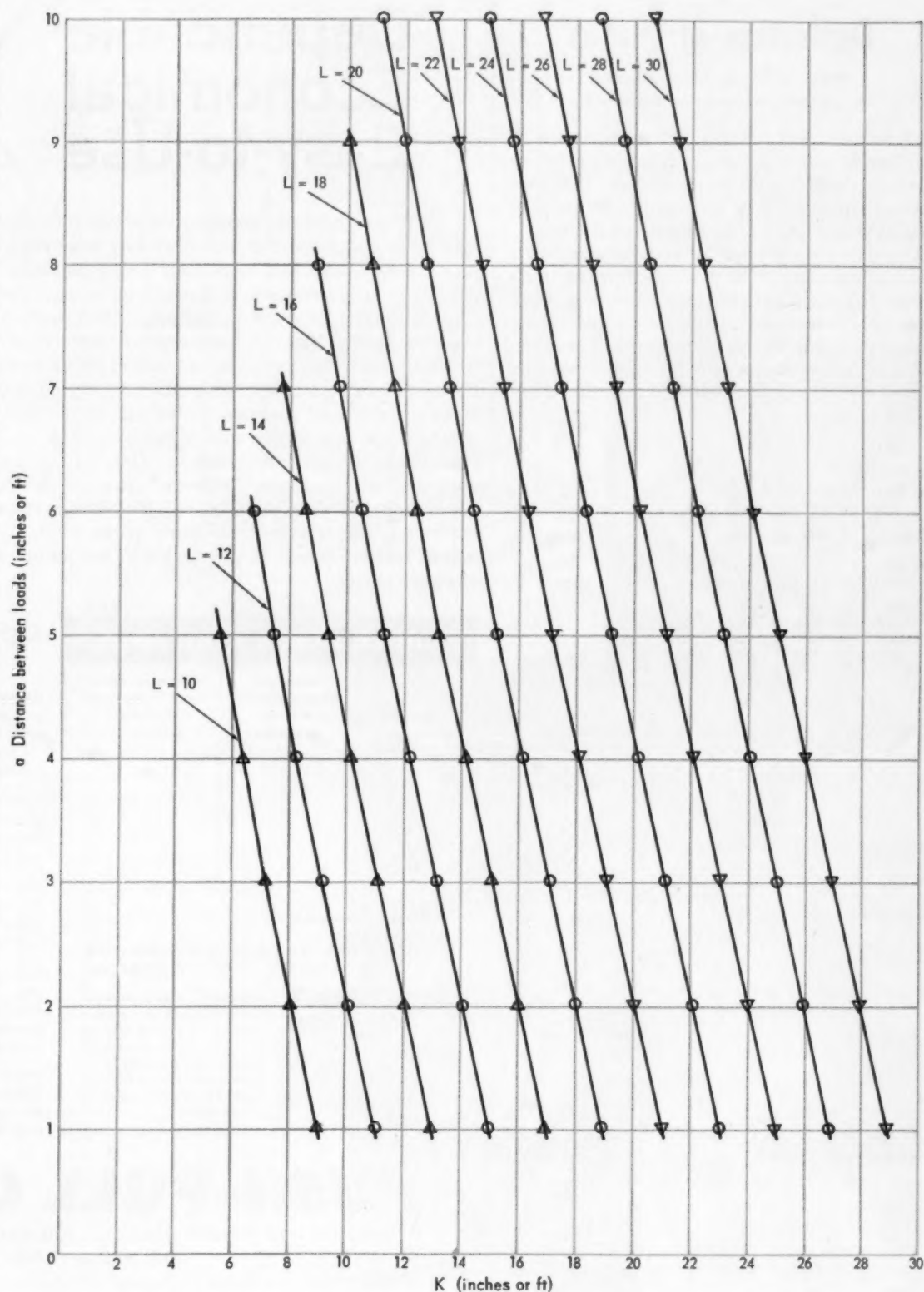
Just estimate the cost (or even the possibility) of making a part like this by machining or stamping—and then compare prices. The part is 3" x 1 1/4" by .005" thick. Contours are held within .0025". Our total tooling charge is \$165.00. Labor in 1,000 quantity is 15c each.

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## Deflection of Plates

Robert M. Sando, Fellow Engineer,  
Air Arm Div., Westinghouse Electric Corp.

These charts will permit rapid determination of deflection and slope of flat plates subjected to pressure loads normal to the surface. The theoretical equations were developed from the principles of the "thick plate theory" (see reference). This theory is valid only if the maximum deflection of the plate is less than 1/2 the plate thickness. The charts are based on a pressure of 10 psi, modulus of elasticity of  $10 \times 10^6$  psi and a Poisson's ratio of 0.30. For other required pressures and elasticities, values from the chart may be increased or decreased in direct proportion to the ratio of  $(p/E)$ .

### Example:

Determine the maximum slope  $\theta$  of a plate with the dimensions  $a = 9$ ,  $b = 6$  and  $h = 0.25$  inch. Assume the modulus of elasticity of the material  $E = 30 \times 10^6$  psi and the pressure  $p = 15$  psi. Poisson's ratio  $\tau = 0.30$

### Solution:

(1)  $a/b = 1.5$ ,  $h = 0.25$ . From Chart 1,  
 $S_{max} = 0.007$  for  $p = 10$  psi and  $E = 10 \times 10^6$  psi.

(2) For  $p = 15$  psi and  $E = 30 \times 10^6$  psi:

$$S_{max} = (0.007) \left[ \frac{15 / (30 \times 10^6)}{10 / (10 \times 10^6)} \right]$$

$$S_{max} = (0.007) (0.50)$$

$$S_{max} = 0.0035 \text{ inch}$$

Because this deflection is less than 1/2 the plate thickness, the design charts are valid for this specific problem.

(3) From Chart 2,  $\theta = 13.7$  minutes of a degree for  $p = 10$  psi and  $E = 10 \times 10^6$  psi.

(4) For  $p = 15$  psi and  $E = 30 \times 10^6$  psi:  
 $\theta = (13.7) (0.50)$   
 $\theta = 6.85$  minutes of degree

Values of  $S_{max}$  and  $\theta$  outside the range of the design charts may be calculated by the equations shown on Charts 1 and 2 and by the data in Chart 3.

### Reference:

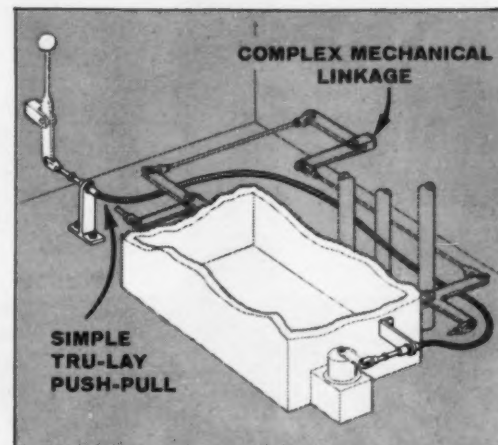
"Airplane Structural Analysis and Design"; Sechler and Dunn; J. Wiley & Sons, Inc.; New York, N. Y.; 1942.

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### CABLE SIZES AVAILABLE

Control Dimension	Minimum Recommended Radius in Inches	Maximum Input Load in Pounds (Dependent on Travel)
3/32"	2	30
1/8"	3	65-125
3/16"	5	115-175
1/4"	6	300-600
5/16"	8	700-1,000

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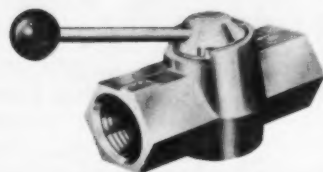
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9200 SERIES

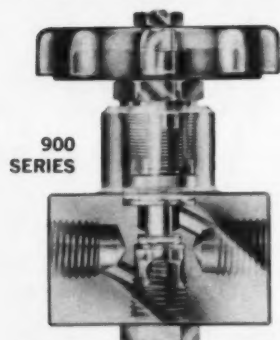
Positive sealing in high vacuums to 150 psi. Sizes  $\frac{1}{8}$ ",  $\frac{1}{4}$ ",  $\frac{3}{8}$ ",  $\frac{1}{2}$ ",  $\frac{3}{4}$ ". Available in brass or 303 stainless.

Design of the Circle Seal 9200 Series Plug Valve features use of three O-rings. In closed position, O-ring on cylindrical face of plug prevents leakage past inlet port. In open position, the valve is fully ported and allows straight-thru flow passage. Stem leakage is entirely eliminated by static O-rings at top and bottom around circumference of plug. Effortless quarter turn from full open to full close. No springs used...no adjustments required.



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## CIRCLE SEAL HIGH PRESSURE SHUTOFF VALVE ...LEAKPROOF Fingertip Operation



900  
SERIES

0-6000 psi.  $\frac{1}{4}$ " pipe and  $\frac{3}{8}$ " tube connections. 303 Stainless construction.

Unique design combines positive leakproof shutoff with full flow passages and freedom from wire drawing. Design of stem and seat permits simplified throttling of flow. Light fingertip operation actuates either a hand-wheel or toggle lever for rapid actuation. Unique and useful variations on the basic 900 Series configuration: • Right angle flow. • Integral Relief—combines relief valve function with shutoff permitting cylinder thermal pressure relief, etc. • Triport with one inlet and two outlets or one outlet and two inlets.



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### MAXIMUM DEFLECTION OF PLATE UNIFORMLY DISTRIBUTED LOAD NORMAL TO PLATE SURFACE - ALL EDGES SIMPLY SUPPORTED

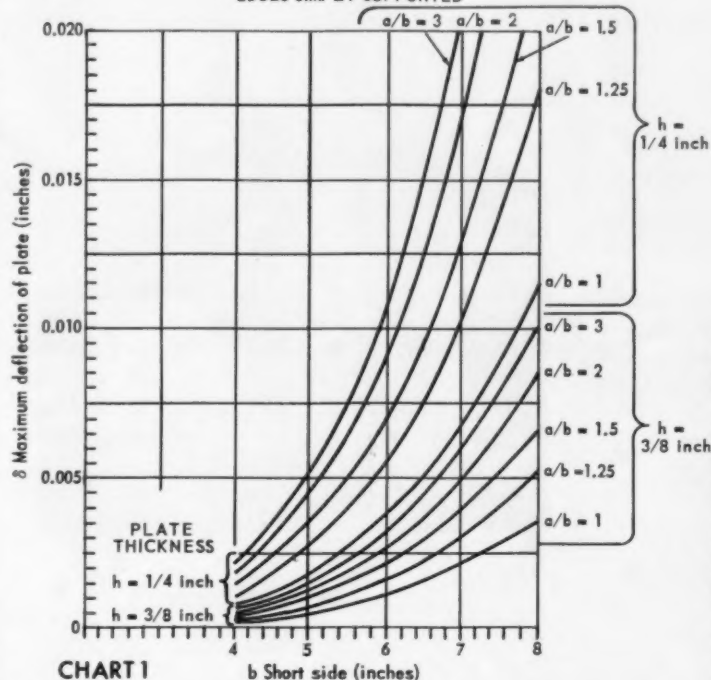
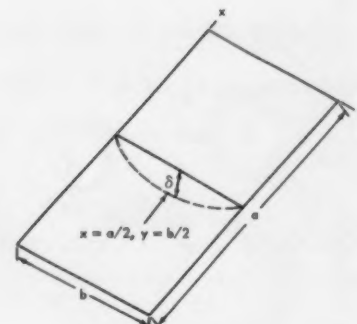
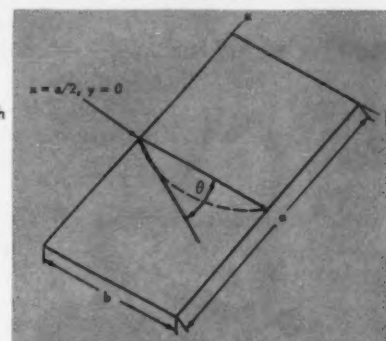


CHART 1



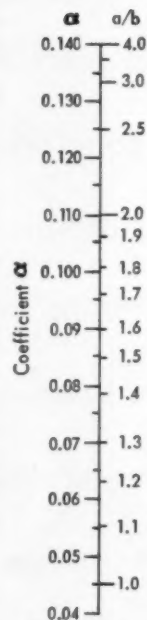
$$\delta = \frac{p b^4}{64 E h^3} \left( \frac{1}{1 + \frac{1}{a^2} + \frac{1}{b^2}} \right)$$

$E$  is assumed:  $E = 10 \times 10^6$  psi  
 $p$  is assumed:  $p = 10$  psi



$$\theta_{\text{radians}} = \frac{0.6 p b^3}{E h^3} \left( \frac{1}{1 + \frac{1}{a^2} + \frac{1}{b^2}} \right)$$

$E$  is assumed:  $E = 10 \times 10^6$  psi  
 $p$  is assumed:  $p = 10$  psi



Poisson's ratio  $\nu = 0.30$ .  
For other values of  $\nu$ , multiply  
 $\alpha$  from chart by  $(1 - \nu^2)/(0.91)$

CHART 3

### MAXIMUM SLOPE OF ELASTIC CURVE UNIFORMLY DISTRIBUTED LOAD NORMAL TO PLATE SURFACE - ALL EDGES SIMPLY SUPPORTED

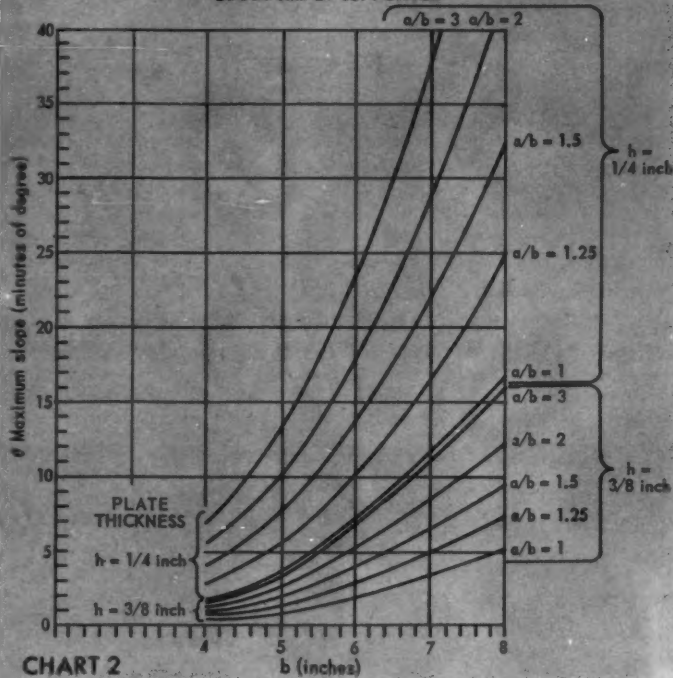


CHART 2

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## DESIGN DATA

### Beam on an Elastic Foundation Maximum Moment and Deflection

S. Warren Kaye, Peabody, Mass.



There are many cases in which a very long beam is supported continuously along its length by a surface that may be regarded as elastic in the sense that it may be considered to deflect in proportion to the intensity of the applied pressure. The condition of loading in the nomograms consists of a bar of infinite length under a single concentrated load. Nomogram I solves for maximum moment, and Nomogram II solves for deflection at the load. Formulas involved are:

$$k = p/y \quad (1)$$

Where:

$k$  = modulus of the foundation

$p$  = pressure (lb/linear inch) required to produce

$y$  = vertical deflection of the foundation (inches).

$$\beta = \sqrt[4]{k/4EI} \quad (2)$$

Where:

$E$  = modulus of elasticity (Aluminum =  $10 \times 10^6$  or Steel =  $30 \times 10^6$  psi) and

$I$  = Moment of inertia of beam section (inches<sup>4</sup>).

$$M = P/4\beta \quad (3)$$

Where:

$M$  = maximum moment (lb-in),

$P$  = applied load (lb)

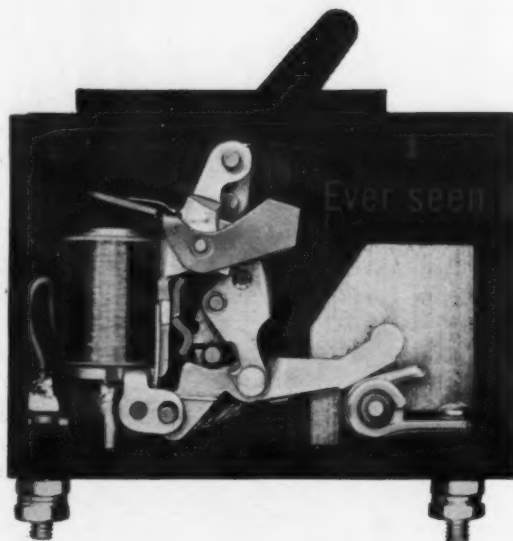
$$y = P\beta/2k \quad (4)$$

Where:

$y$  = maximum deflection (inches)

Example: Given a beam on an elastic foundation where  $p = 15$  lb/linear inch, producing a vertical deflection  $y = 0.015$  inch subjected to an 800-lb load.  $I$  of beam is  $0.1$  inch<sup>4</sup> and  $E = 10 \times 10^6$  psi. Solve for maximum moment and maximum deflection at point of loading.

Solution: Using Nomogram I, align  $p = 15$  with  $y = 0.015$ , intersecting  $k = 1000$ . Align this intersection with  $I$  (left hand scale) =  $0.1$ , intersecting  $\beta = 0.1257$ . Align this intersection with  $P = 800$ , intersecting  $M = 1600$  lb-in. Using Nomogram II, align  $\beta = 0.1257$  (as determined from Nomogram I) with  $P = 800$ , intersecting the reference line. Align this intersection with  $k = 1000$  (as determined from Nomogram I), intersecting  $y_{max} = 0.05$  inch.



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now. This Heinemann hydraulic-magnetic

circuit breaker is rated at exactly 0.010

amperes. We could just as easily have

made its rating 0.5 or 1.7 amps or, for

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current levels, think of the possibilities of the Heinemann breaker. It is tem-

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several inverse time delays (or instantaneous-trip action); and it can be had in

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Guide, Bulletin 201, will give you detailed information. Write for a copy.

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DESIGN NEWS—OCTOBER 27, 1961



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**NEW  
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SWIVEL JOINTS**

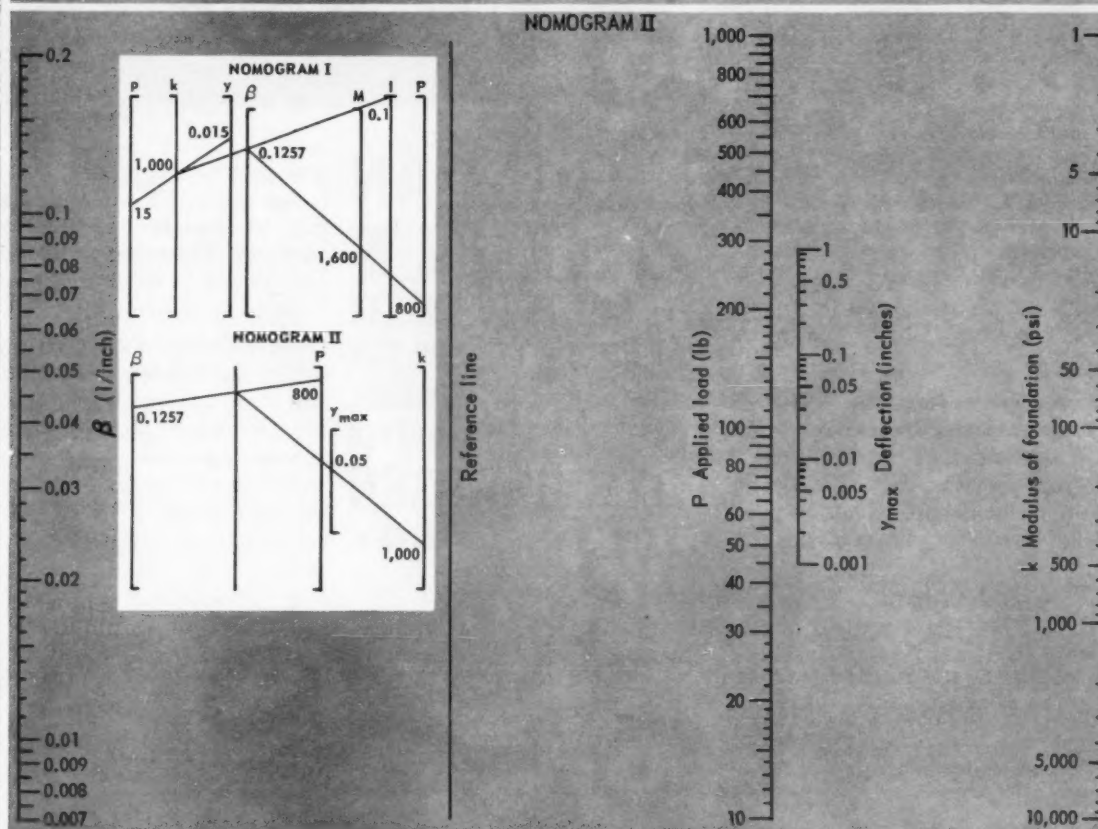
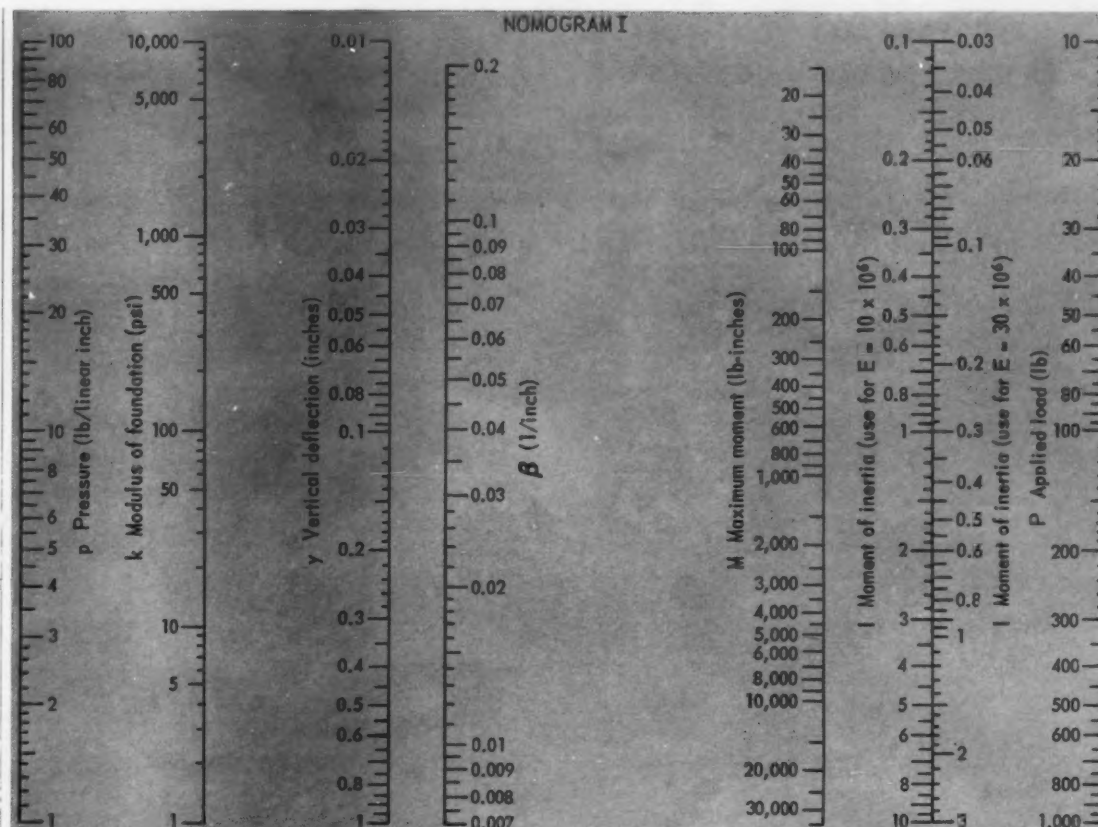
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**CHIKSAN COMPANY** BREA, CALIF.

61-58 A

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WE CAN PLATE IT!  
NO MATTER WHAT THE SIZE  
OR SHAPE OF YOUR PRODUCT,  
IT CAN BE COATED BETTER  
WITH KANIGEN<sup>®</sup>  
NICKEL ALLOY**

process involving no electric current, it works equally well on simple or complex shapes and on small or large surfaces. Thickness uniformity of the coating is independent of part complexity or size.

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Kanigen Division

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## NEW LITERATURE

To obtain copies of numbered literature . . . circle appropriate number on Reader Service card.

### Oscilloscope Cathode-Ray Tube Replacement Chart

451

This four-page chart lists the oscilloscopes of 78 manufacturers by name and model number with the company's replacement CRT. The chart lists 350 different model numbers and their corresponding replacement numbers. Sylvania Electric Products, Inc., 1100 Main St., Buffalo 9, N. Y.

### Picture Tube Interchangeability Guide

452

Contains interchangeability information on 260 types of television picture tubes. This wall chart (24 inches high by 8-1/2 inches wide) folds to convenient desk or service case size. Picture tube types currently in use, alternative replacements and circuit changes required, if any, are listed. General Electric Co., Electronic Components Div., Owensboro, Ky.

### Mathematical Handbook

453

This pocket-sized handbook of formulas and arithmetical rules contains powers and roots, logarithms, decimal equivalents, circular arc tables, mensuration formula, weights and measures and conversion factors. Business formulas such as profit and loss, mark up, discount, and simple and compound interest tables are included as well as general arithmetical rules. Curta Co., 14436 Sherman Way, Van Nuys, Calif.

### Spectrum Analyzer Techniques

454

A new edition of this handbook offers detailed measurement techniques using the spectrum analyzer, as well as a history and general theory of operation of the instruments. One portion of the 56-page handbook describes the spectrum analyzers currently available, including a new lightweight, transistorized model. Other sections include design considerations and application notes for the units. Polarad Electronics Corp., 43-20 34th St., Long Island City 1, N. Y.

### Free Loan and Rental Motion Pictures

455

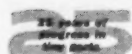
This 34-page catalog contains a complete listing of 16-mm sound motion pictures available from the distributor. Subject matter of the free loan films includes agriculture, business and economics, communications, home economics, industry and manufacturing, science and engineering, and the world scene. Rental subjects include safety education films, business and industry, foreign travel, Walt Disney and feature films. Association Films, Inc., Broad at Elm, Ridgefield, N. J.

### Rigid Coaxial Transmission Lines

456

This 42-page catalog covers microwave product lines geared to space-age electronics. Products include coaxial transmission line equipment, antennas, waveguide, accessories, components and systems. Photographs, schematics and cutaways illustrate the products, and specifications and engineering data are included. Special devices featured include beacons, cavities, mixers and test equipment. Telerad, Div. of The Lionel Corp., Rte. 69, Flemington, N. J.





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A complete line: 1/8", 1/4", 3/8", 1/2", and 3/4" female Dryseal Pipe Sizes in all models and types. Equivalent Aeronautical Tube Sizes on special order.

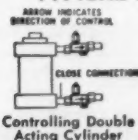
**MINIMUM PRESSURE DROP AND POWER LOSS...** Oversize ports and passages give maximum flow at minimum pressure drop, insure greater accuracy and response in hydraulic or large volume air cylinder control.

**EASY FLOW ADJUSTMENTS** under full pressure. Seal located at port to eliminate air or dirt traps. Gland structure equally effective on pressure or vacuum.

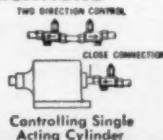
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### TYPICAL APPLICATIONS



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Model KF Knob and Dial Flow Control Valve or Model KF Needle Valve for hand mounting



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## Educational TV System 457

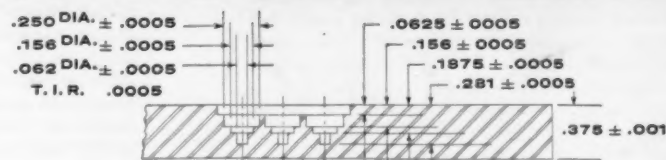
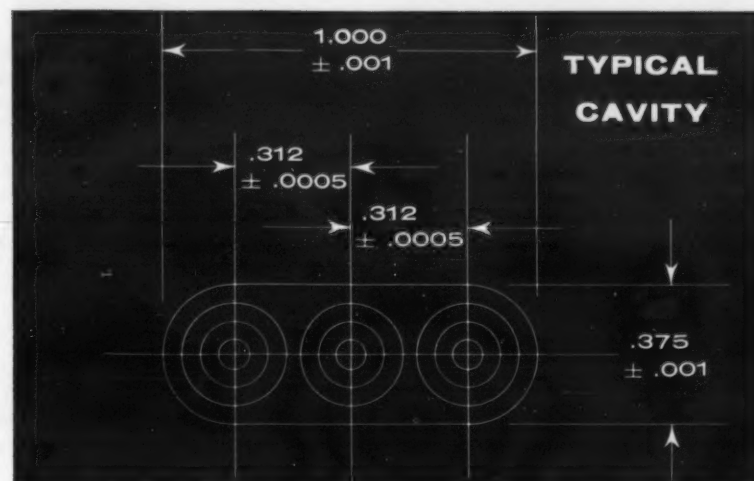
A four-page bulletin, "Tele-Quest", describes a closed-circuit television system with provisions for immediate and adequate student-instructor communication. The step-by-step procedure is diagrammed pictorially and technical specifications are given for systems from 6 to 24 stations. Community Engineering Corp., 234 E. College Ave., State College, Pa.

## Plastics Fact File 458

This revised file describes properties and typical end uses of a line of plastics. Intended as a guide to those who buy or specify plastics materials, the 16-page booklet gives results of American Society for Testing Materials tests on a broad range of "Lustrex" styrene, "Monsanto Polyethylene", "Opalon" vinyl chloride and "Lustran" SAB and SAN molding and extrusion compounds. General information is included about forms, typical uses and characteristics of fabricating, extruding, calendaring and laminating materials; industrial, textile, surface and paper coating resins; adhesives and intermediates. Monsanto Chemical Co., Plastics Div., 812 Monsanto Ave., Springfield 2, Mass.

## Steel Design 459

Newest design concepts and significant developments in constructional steels are included in a 28-page compilation of technical data for those who design, fabricate and build with structural steels. Entitled "New Steels... New Shapes... New Concepts... Toward More Efficient Steel Design and Construction", the guide contains key facts on structural carbon steels A7, A373 and A36; high-strength, and high-strength low-alloy steels A242, A440 and A441; and heat-treated constructional alloy steels "T-1" and "T-1" type A. Featured is a section on 11 new wide-flange beam sections recently made available, and how they can be used efficiently. Market Development Div., U. S. Steel Corp., Room 2809, 525 William Penn Pl., Pittsburgh 30, Pa.



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## LITERATURE

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### TV Knob Cross-Reference Guide 460

This guide makes it possible to find the TV set model number in chronological order and to determine which knob to select from stock without referring to any other listings. More than 3500 different TV set models are listed. Manufacturers included are: Admiral, Crosley, Emerson, General Electric, Hoffman, Hotpoint, Motorola, Muntz, Olympic, Philco, Radio Corp. of America, Sylvania, Westinghouse and Zenith. TV Development Corp., 469 Jericho Turnpike, Mineola, N. Y.

### Semiconductor Reliability 461

"New Dimensions in Semiconductor Reliability" is an eight-page report on extra measures that mean better semiconductor performance. Design and test measures are explained, forming a practical guide for evaluating reliability in semiconductors. Also available is an eight-page semiconductor catalog covering low-, medium- and high-power silicon rectifiers, silicon-rectifier assemblies, high-voltage silicon power transistors, controlled rectifiers, thermistors, thermoelectric coolers and generators. Westinghouse Electric Corp., Semiconductor Dept., Youngwood, Pa.

### Gyroscopes 462

A revised edition of "Technical Information for the Engineer" details the theory, performance, application, construction and testing of such gyroscopic instruments as rate, rate integrating, free, vertical and directional gyros, as well as stable platforms and accelerometers. The 60-page publication discusses drift phenomena and advanced gyro designs such as gas bearing gyros, cryogenic gyros, electrostatic gyros and particle gyros. Diagrams, equations, charts, graphs and photographs illustrate the text. Kearfott Div., General Precision, Inc., 1150 McBride Ave., Little Falls, N.J.

### Control and Shut-Off Valves 463

An aid in determining the best valve for a specific need, this eight-page brochure explains zero leakage valves, control valves and line valves. A control-valve data sheet is included with the bulletin for use in setting forth valve problems on special applications. Basic valves are immediately available with a minimum delay on special application orders. Hansen-Lynn Co., Inc., 800 S. Flower St., Burbank, Calif.

### Stopwatch and Synchronous Chronoscope Selector 464

More than 100 different timers for measuring intervals to 1/100 sec for all segments of industry are described in a 16-page selector. Data and specifications on construction, method of operation, size and reading are given for each timer. The catalog is divided into sections describing the central register, special-purpose timers, split-second timers, time and motion equipment, sports timers, wrist chronographs and panelboard instruments. Heuer Timer Corp., 441 Lexington Ave., New York 17, N. Y.

### Galvanized Steel Handbook 465

Explains the criteria for long serviceability of hot-dip galvanized products. Part I of the 32-page manual covers the production and properties of galvanized steel, its corrosion resistance, the galvanizing process and structure of the coating. Part II deals with the inspection of galvanized-steel articles, thickness and uniformity of coating, comparison of coating weight requirements, adherence of the coating and conditions for inspection. Other subjects discussed include embrittlement of the basis metal, hydrogen absorption and general factors in design and fabrication. American Zinc Institute, Inc., 292 Madison Ave., New York 17, N. Y.

### Transformer Color-Code Chart 466

This wall chart shows color codes for power audio, output and IF transformers, as well as connection codings for loudspeaker leads and plugs. The chart measures 8-1/2 by 11 inches and is printed on index paper stock. Stancor Electronics, Inc., 3501 Addison St., Chicago 18, Ill.

### Steel Cabinets, Files and Shelving 467

This 1961-1962 reference manual No. 488 covers a line of steel equipment. Shelving, bins, doors, slotted angles, drawer units, lockers, benches, grating, counters, merchandisers, trucks, stands and sorting files are illustrated and described. The 64-page catalog provides model numbers and specifications of all units to facilitate ordering. Equipto, Aurora, Ill.

### Fabricating Flexible Plastics 468

A new technical case history series covering fabrication of vinyl and other flexible plastics is available. The first issue features fabricating techniques involved in production of unusual identification bracelets for hospital use. The second issue features the solution to packaging problems requiring a package design suitable for point-of-purchase display and reuse by the consumer. Polo Plastics Co., 1718 N. First St., Milwaukee 12, Wis.

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### Industrial Brushing Tool Nomenclature

469

"Standard Nomenclature for Construction of Industrial Brushing Tools", 14 pages, illustrates every conceivable form of brush construction for industrial applications. Cross-section drawings illustrate characteristics of power-driven cylinder brushes, "twisted-in-wire" brushes and strip brushes. Methods of setting bristles are shown and component parts of each type of brush are identified. This guide represents the first effort to create a system of standards for the brush industry. M. W. Jenkin's Sons, Inc., Cedar Grove, N.J.

### Precision Mechanical Differentials

470

Brochure 8101, 44 pages, provides general information and design criteria on a line of precision mechanical differentials. A group of stock and pre-engineered differential drawings are included as well as a test report on an actual stock differential. A special section of the brochure contains 27 drawings of stock and pre-engineered differentials. These drawings are "A" size and are printed on perforated pages so that they can be detached and reproduced by "Ozolid" or traced for use in conjunction with existing drawings. Specifications required and factors to be considered when selecting a differential for a particular application are included. Dynamic Gear Co., Inc., 175 Dixon Ave., Amityville, L.I., N.Y.

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### TFE O-Rings

471

Intended as a complete reference for engineers and purchasing agents, this four-page catalog, P-1A, lists more than 250 sizes of tetrafluoroethylene fluorocarbon resin O-rings. Nominal dimensions of ID, OD and width are provided along with actual decimal dimensions and tolerances for ID and width. All O-rings are classified by Society of Automotive Engineers' ARP-568 dash numbers, and packing and gasket numbers for AN-6227 and AN-6230 are given where applicable. The four-page brochure lists prices for quantities up to 20,000. The manufacturer states that all sizes are in stock and available for immediate delivery. The "Mirror Finish" TFE O-rings have high chemical stability and heat resistance. Chicago Gasket Co., 1271 W. North Ave., Chicago 22, Ill.

### Constant-Force Extension Springs

472

Section 6 consists of 10 pages of design data on "Negator" constant-force extension springs. Step-by-step procedure for designing these elastic members and 14 easy-to-use design tables are included. Line drawings illustrate the data, and information presented covers graphical description of load-deflection characteristics, graphical description of size-load-life relations, mounting considerations, free-end engagement, application limitations, design procedure and design tables. Hunter Spring Co., A Div. of American Machine & Metals, Inc., Lansdale, Pa.

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### Adjustable-Speed Drives

473

"Adjustable-Speed Drives . . . How to Analyze . . . How to Compare . . . How to Select" is a 32-page book covering a complete line of adjustable-speed drives ranging from 1/20 to 1000 hp. Principles of operation, drive components, control functions, features and outstanding advantages of the drives are covered. A major portion of Bulletin GEA-6999 analyzes the functional requirements of the drive. A price-comparison table reflects typical drive price curves plotted against drive horsepower. General Electric Co., Schenectady 5, N.Y.

### Solutions to Adhesive Problems

474

This 12-page booklet presents the solution to many difficult adhesive problems, describes how the company handles the 36,000 problems a year referred to it and gives a brief outline of capabilities and facilities. Many new adhesives, coatings and chemical compounds for a variety of industrial applications are included. Adhesive Products Corp., 1660 Boone Ave., New York 60, N.Y.

### Radiant Heat

475

"Radiant Heat . . . Tool of Industry" explains the principle of radiant heat and describes the manufacturer's line of equipment designed for utilization of the electric

infrared radiant heating process. The eight-page bulletin illustrates some of the industrial applications of radiant heat. Fostoria Corp., 1200 N. Main St., Fostoria, Ohio.

### Glass, Plastic and Ceramic Capacitors

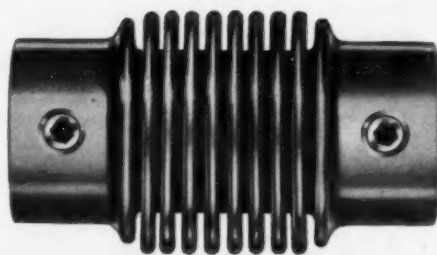
476

Bulletin 314-3, 16 pages, covers a line of glass, plastic and ceramic capacitors. Featured in the booklet are glass trimmer capacitors just released to the OEM trade. These capacitors are for use in panel-mount or printed-circuit-mount applications. Complete specifications are provided for all units as well as characteristics, schematics and general descriptions. Erie Resistor Corp., 644 W. 12th St., Erie, Pa.

### Nickel-Base Alloy

477

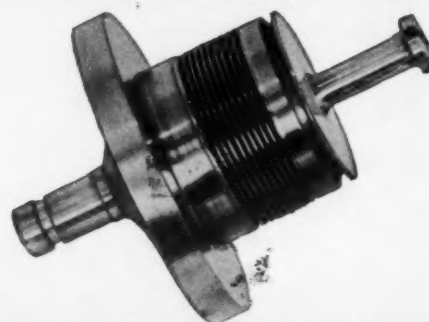
"Hastelloy" Alloy X—its chemical composition, physical properties, oxidation and carburization resistance, hardness, formability, impact strength and dynamic elastic modulus—is described in Form F-30,037C. The 28-page revision includes short-time tensile data, rupture, creep and average total elongation data, and fabrication details. Haynes Stellite Co., Div. of Union Carbide Corp., 270 Park Ave., New York 17, N.Y.



## Flexible Couplings

### Eliminate backlash, end-play; absorb vibration and shock

Servomechanisms, instruments and similar drive and control systems are the big users of these small units. Robertshaw flexible couplings are ideal for guarding against misalignment, friction and bearing wear problems. Save space and weight. Simplified design utilizes seamless metallic bellows, in choice of several metals, connected to two hubs. Stock sizes accommodate shafts from 1/8" to 1/2". Other sizes custom-engineered. Write for Bulletin 80.



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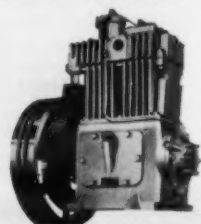
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## TECHNICAL PAPERS

### Programming Numerical Positioning Control

H. Ankeney, Giddings and Lewis Machine Tool Co., Fond Du Lac, Wis.

MANUSCRIPT FOR MACHINE & OPERATOR COMMANDS, G&L 65-H5-T Machine

PART NO. \_\_\_\_\_ OPER. NO. \_\_\_\_\_ PART NAME \_\_\_\_\_ MATERIAL \_\_\_\_\_  
PROGRAMMED BY \_\_\_\_\_ CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_ PAGE NO. \_\_\_\_\_

SEQUENCE NUMBER	PREP FUNC	TABLE POSITION	HEAD POSITION	SADDLE POSITION	MILG. FEED	SPDL. FEED	SPDL. SPEED	TOOL FUNC	MISC FUNC	OPERATORS INSTRUCTIONS
n001	g12	x1234567	y1234567	z1234567	f123	e123	s123	t123	m123	Fig. 1
n002										
n003										

The programmer is the most important link in the chain from the designer to the finished part. He must be a combination of methods engineer, tool engineer and machine operator.

A programmer who understands and uses all the features provided in a control is necessary to an efficient and economical installation. The simple two-axis positioning control is a big help in reducing operator error, fixture cost and manufacturing time; but it is only when a programmer can control all axes and auxiliary functions the way an operator does that the biggest payoff can be achieved. The control should have machining modes that permit fast, heavy cuts for roughing and fine, precision cuts for finishing. It should be possible to call for boring, drilling, tapping and other cyclical operations by an auxiliary function. Feed rates, speeds and even the tool should

be programmable to enable numerical control to deliver its full potential.

The programmer starts with a drawing of the part to be manufactured and a manuscript that looks something like Fig. 1, on which he will enter the machine and operator commands. To keep the programmer's confusion to a minimum, Electronic Industries Assn. has a committee working on a standard that will make all manuscripts as similar as possible. The sequence of the columns and the code numbers used in the columns all are dictated. It may be two years before this standard is issued, but many of the principles already are worked out.

Starting in the left-hand column of Fig. 1, the sequence number is a three-digit number to allow for reference to any particular line or block of information. Each block constitutes a machine command.

The next column is for preparatory functions. These are code numbers used to set up the control for various modes of operation such as drilling or tapping. Sometimes they are used to indicate plane selection or feed direction.

The next columns are used to set down dimensional information for axes being controlled. These may or may not be preceded by a plus or minus sign and may consist of different numbers of digits. Even those with the same number of digits may differ because the position of the decimal point may be different. The period or decimal point should not be coded in the tape, though most controls will ignore it.

Following the dimensional columns are those applying to feed rates and speed. In these will be code numbers which will indicate the desired feed in inches per minute or inches per revolution and speed in rpm.

The EIA committee has worked out a three-digit code that can cover numbers from 0.0001 to 99,500. The second and third digits of this coded number are

FLEXOWRITER NC-1 Character Codes

1	2	3	4	5	6	7	8	
0 (Zero)								S
1								T
2								U
3								V
4								W
5								X
6								Y
7								Z
8								.
9								,
A								/
B								+
C								-
D								%
E								Space
F								Back space
G								Tab
H								Stop
I								Upper case
J								Lower case
K								End of block
L								Delete
M								Tape feed
N								
O								
P								
Q								

1 2 4 8 PC O X CR

Fig. 2



the feed or speed rounded to five-digit accuracy. The first digit of the coded number has a value three greater than the number of digits to the left of the decimal point of the feed or speed. If there are no digits to the left of the decimal point, then the number of zeros immediately to the right of the decimal point is subtracted from three to provide the value of the first digit.

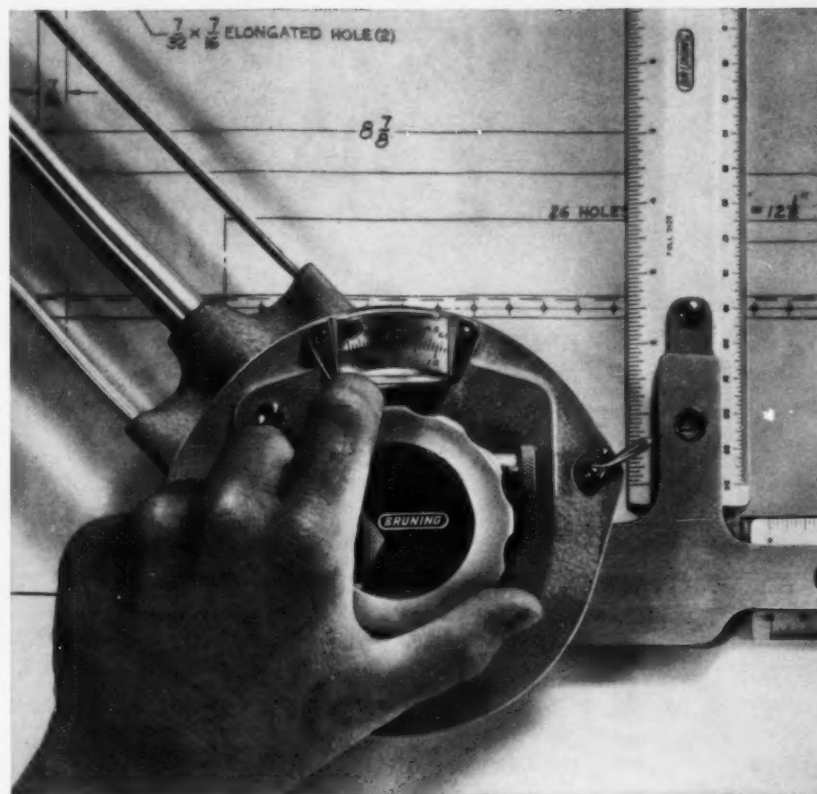
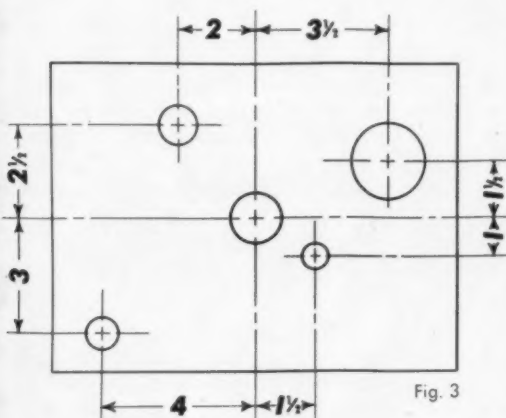
For example, 1728 is coded as 717; 7.82 is coded as 478, and 0.00876 is coded as 188. With a little practice, this code can be read directly. We hope control builders will arrange to accept these codes and cause the machine to provide the nearest possible feed or speed.

The column for tool function will have a code number for the tool to be selected in tool-changing machines, or the number may be displayed to signal the operator which tool to put in the spindle.

Miscellaneous functions are code numbers used to turn on the coolant, start the spindle or clamp the table. An attempt is being made to standardize these numbers so they will mean the same thing to all controls.

In the last column is typed any information which the operator may need. On machines where the third axis is not controlled, this may tell him the depth of cut. If tools are not coded, this may tell him the tool to be used. Whatever the instruction, this is not coded in the machine control tape. The machine operator should receive a copy of the manuscript when he gets the job, and he should use the sequence number to correlate his instructions with the operation to be performed.

After the programmer has written down all the machine and operator commands necessary to make the part, he turns the manuscript over to a typist to prepare the media used to control the machine.



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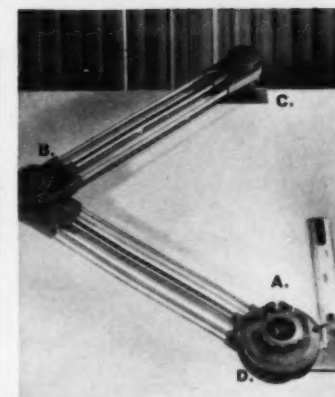
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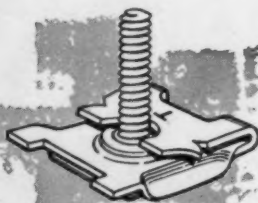
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Designers and Engineers*

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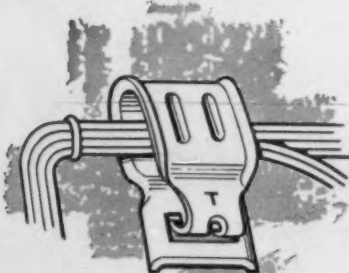
**VERSATILE COMPRESSION RING** has solved fastening problems in car radios, pressure gages, washers, and speaker cabinets. Simply squeeze compression fingers with pliers to expand... release, and spring tension maintains firm connection. Heat-treated spring steel of this SPEED CLIP® fastener won't lose tension, won't loosen under vibration. Possible applications are practically unlimited.



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## PAPERS

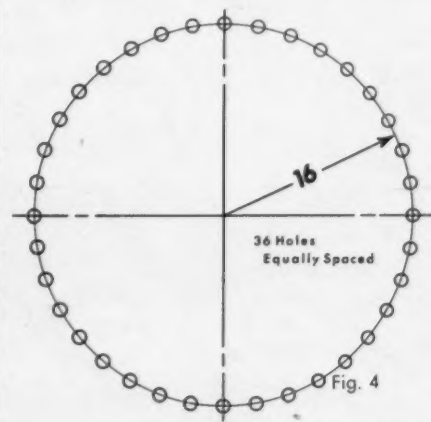
In its usual form the tape preparation equipment consists of a typewriter, a tape punch and a tape reader combined into one unit. As keys are pressed, the manuscript is printed on paper and the hole patterns are punched in the tape.

Nearly all systems being designed today use an 8-channel, 1-inch-wide punched tape with the "Flexowriter" NC-1 code, Fig. 2. This weights the first four channels, 1, 2, 4 and 8. All numbers are made up as binary-coded decimals from combinations of these numbers. The other four channels are Parity, Zero, X and End of Block, or Carriage Return. Letters are made up from number combinations plus Zero or X or Zero and X. Besides numbers and letters, the principal codes used are plus, minus, period (decimal point), space, tab and carriage return. Obviously, space, tab and carriage return do not make a mark on the manuscript.

The parity channel is used to make every row have an odd number of holes. If the code would otherwise result in an even number of holes, an extra one is thrown into the parity channel. On reading, the control checks the quantity of holes so that if it should miss one, an even number would be read and an error indicated.

Most positioning controls operate on absolute dimensions. That is, all points are specified in terms of their distances from reference planes. The intersection of these reference planes is called the reference point.

Some controls have a fixed reference point which is usually out of the work



(Continued on next page)

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## Boxed in by present materials?

### KRALASTIC

Often design ideas are left on drawing boards due to the unavailability of proper materials. In fact, many companies have been unable to put advanced designs into production solely because of this condition. There is a solution, however, Kralastic® ABS resins.

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And Kralastic permits more advanced styling. Its long-

term design strength allows for thinner walls. It can be easily injection molded, vacuum formed or deep drawn without damage to its surface or impairment of its physical properties. Moreover, Kralastic allows complete units to be molded, eliminating post-operational labor, assembly, and finishing costs.

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Vol. 4, Issue No. 1

Bartlett, Illinois (Chicago Suburb)

Progress Edition

# Extra Tough, Extra Clean, Extra Scale-Free because only SETKO Screws are Isothermal Heat Treated

**THIS HEAT TREATING PROCESS  
IMPARTS A DISTINCTIVE  
BLUE-BLACK COLOR WHILE  
PROVIDING DISTINCTIVE  
PERFORMANCE  
CHARACTERISTICS . . . YET, IT  
COSTS YOU NOTHING EXTRA.**

Extensive use has proven that socket screw products treated by this process are tougher and cleaner. Threads, heads, points, shanks, etc. are scale-free. This means better fit, better performance. Also, Isothermal heat treated socket screw products prevent decarburization...and it costs you nothing extra. It's another Setko exclusive in the socket screw field.



**only Setko socket screw  
products have this  
distinctive, unplated,  
blue-black color**

Scale free

Tougher finish

Prevents decarb

Can be  
directly plated

## Standard on most Setko socket screw products

Isothermal heat treating has been adopted by Setko as a standard on most standard and special socket screw products including; hex socket, fluted socket, and slabbed head set screws as well as hex socket cap screws. (Stainless steel screws are generally not heat treated.) Unless you specify otherwise, screws that you order in these primary categories, regardless of points, or locking actions, will be isothermal heat treated. It costs you nothing more for this bonus value extra.

## Take the Setko "Look Test"

Compare the unplated finish of Setko socket

screws with other products using other methods. You'll see the cleaner, scale-free threads, heads and points that have made Setko socket screw products outstanding in their field. Write for test samples. Send us your specifications and requirements for advantageous quotations.

## Isothermal heat treating minimizes distortion

You get low cost, more dependable performance on the production line and in the field — Isothermal heat treated screws have a minimum of distortion. Far less than commonly used methods. Screws fit better, hold tighter. It's the same heat treating method used by manufacturers of precision products such as: razor blades, etc. B-187

## Setko engineers will reanalyze your socket screw product requirements

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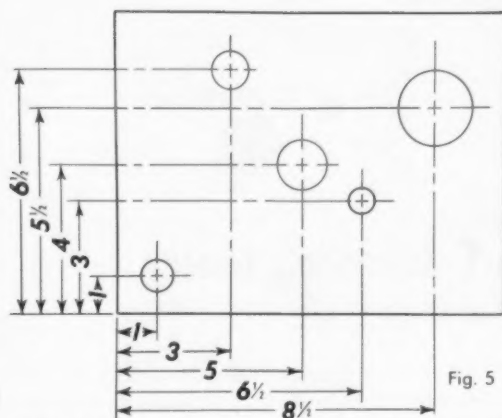


Fig. 5

area. Some permit various amounts of movement of the reference point to accommodate setup of workpieces.

Fig. 3 is typical of the type of drawing that requires the ability to set the reference point on the workpiece for maximum programming convenience. This means plus and minus programming to call for the position of points in the four quadrants surrounding the reference point.

If bolt-circle drilling is to be done on a machine that moves only in Cartesian coordinates (Fig. 4), it is most convenient to set the reference in the center of the circle. The programmer uses a table of fractions which, when multiplied by the bolt-circle radius, will give the X and Y coordinates of the holes.

For controls without reference offset or only a limited range, the drawings should be arranged with references on the work edge and located with regard to the way the piece will be set up on the machine, Fig. 5.

Reference offset can be provided as a hand-cranked function, or with a slewing motor for gross movements and a dial for fine movements, or as a completely automatic servoed function.

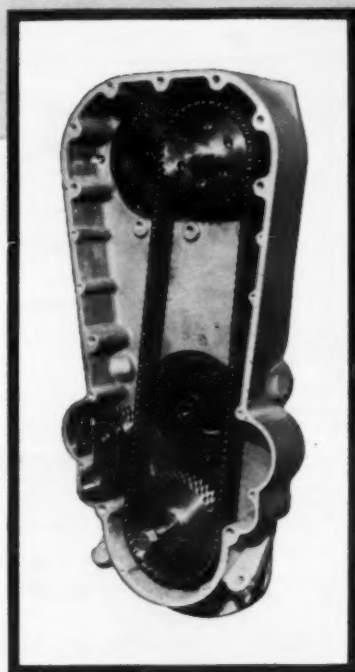
In programming rotary motions, there seems to be divided opinion on whether we should use decimal degrees or decimal circles. Decimal-circle programming gives numbers less than one. The decimal-circle proponents point out that a given number of digits will break the circle down into smaller bits; the table will always rotate the shortest way to its next location, and continuing revolutions will not get the position out of step. The decimal-degree proponents argue that people think in terms of degrees.

In summary, we should remember that the programmer is the most important link in the chain from the designer to the finished part. He should be as knowledgeable as possible in the area of machining practices and methods.

*Abstracted from a technical paper presented at the 25th Annual Machine Tool Electrification Forum; Sponsored by Westinghouse Electric Corp., Pittsburgh, Pa.; April 19 and 20, 1961.*



Photo courtesy Champion Spark Plug Co.



The supercharger drive was designed and installed by Cragar Equipment Company.

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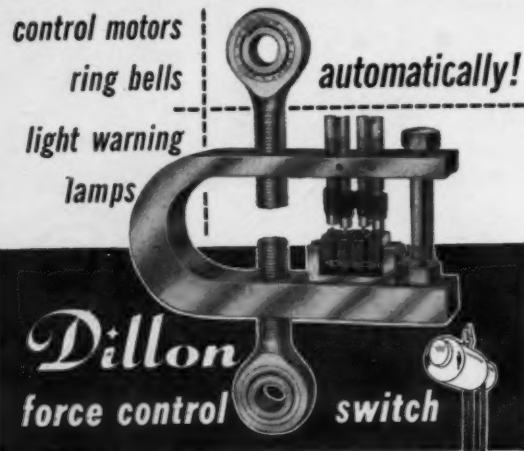
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## DESIGN DESIGN IDEAS NEWS

CONTROLS

### SCR Amplifier Controls A-C Induction Motor

Edward W. Schrader, Western Editor

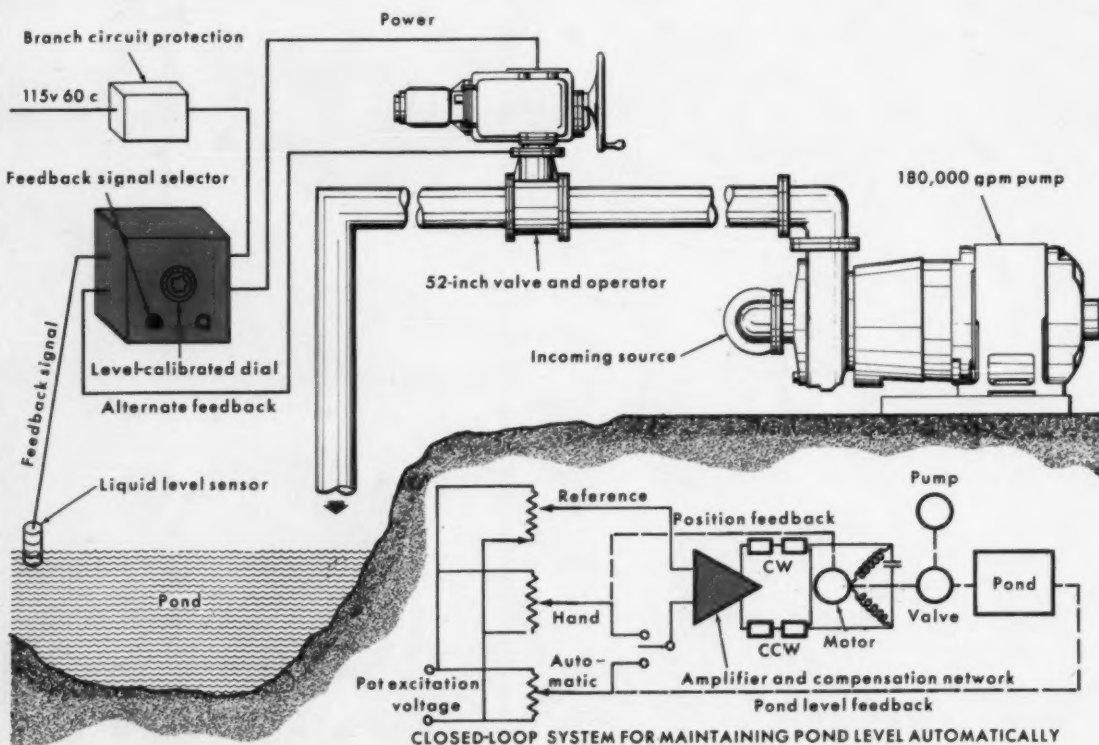
An amplifier using silicon-controlled rectifiers operates from low-level d-c signals to position single-phase or polyphase a-c induction motors. The design eliminates all relays and moving parts, such as reversing motor starters and rotating motor amplifiers, to increase reliability of industrial control systems.

The control amplifier first sums and then amplifies the error signal. Clockwise or counterclockwise pulse oscillators then gate silicon-controlled rectifiers for proper directional rotation. The SCR's essentially pulse the a-c induction motor in a manner similar to a relay-operated d-c servo.

The circuit design avoids the possibility of short circuits while switching the polyphase motors. The control rectifiers are protected from line voltage transients.

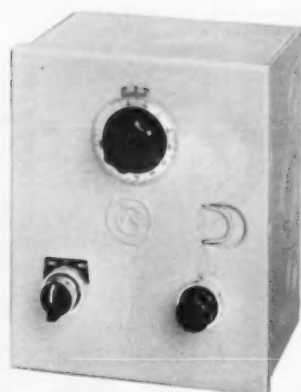
The technique accurately positions large loads in direct proportion to the d-c electrical signal. Amplifier impedances are matched to accept most process control instrument d-c output signals. The device may be installed in existing manually controlled systems using motor-operated valves.

The Power-Max Servo Amplifier is a design of Electromotion Co., Venice, Calif., a subsidiary of Del Mar Engineering Laboratories.

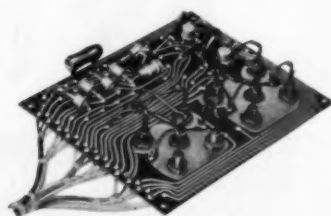


**AUTOMATIC CONTROL SYSTEM** maintains pond level for varying outfall. Continuously operating pump supplies water to motor-operated valve. Calibrated dial on servoamplifier sets desired pond level. Amplifier then controls valve position to replenish water in pond. In automatic mode, liquid-level sensor supplies feedback signal to amplifier. In manual mode, alternate feedback potentiometer on valve positions valve.

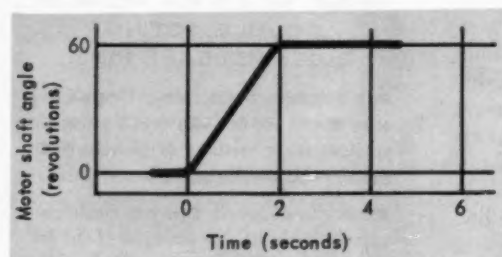




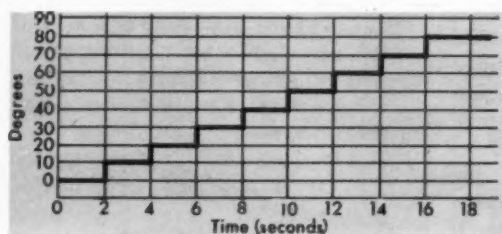
**SERVOAMPLIFIER** operates on 115v, 60-cps, 30-wa supply for its control circuits. Typical positioning accuracy is 0.3 percent of full scale.



**PRINTED-CIRCUIT BOARD** for servoamplifier uses solid-state components. Amplifier is transistorized. Silicon-controlled rectifiers switch a-c power to drive motors up to 5-hp, 3-phase, 60-cps, 220v rating.



**STEP FUNCTION RESPONSE** of control has negligible time constant, thus maximizing servo loop stability. Amplifier operates functionally as reversing motor starter, but step function response is adjustable with anticipation (rate) and gain controls.



**RAMP FUNCTION RESPONSE** with 0.3 percent accuracy shows induction motor operation on 60-cps power. Control operates motor at virtually any speed between zero and synchronous.

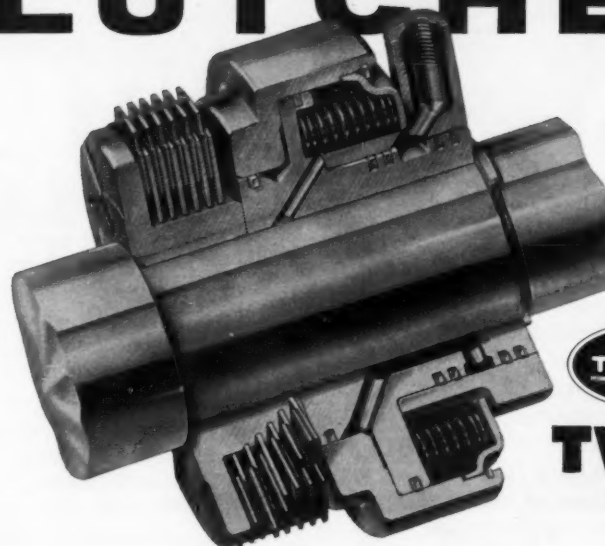
Off the shelf



... or off the drawing board



# “WET” CLUTCHES



Designers who want a dependable multiple-plate “wet” clutch usually find what they’re looking for at Twin Disc. Clutches built to run in oil have been a Twin Disc specialty since 1923, so Twin Disc application engineers know from experience what a wet clutch will and won’t do. They’ll be glad to advise you accordingly.

It’s more than likely that a standard Twin Disc assembly will satisfy your wet clutch requirements. You can specify hydraulic, electric, air or mechanical actuation, and there’s a wide range of standard sizes to meet

the specific torque load of your equipment.

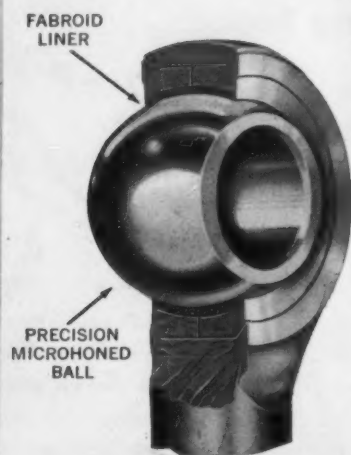
Twin Disc experience is especially valuable where unusual design problems such as high energy loads or rapid cycles are encountered. The most talked-about feature on the new John Deere “1010” Crawler Tractor—an automatic direction reverser—is the result of a special Twin Disc duplex clutch design. Many machine tools of recent design also incorporate special Twin Disc wet clutches for fast, accurate control of table and spindle movements. Assuming rea-

sonable volume, Twin Disc engineers will undertake to design a special clutch for *your* application.

Twin Disc’s backlog of research information will minimize your developmental costs. And there’s a plentiful inventory of standard clutch plates and other parts on hand to keep your tooling costs low. In fact, Twin Disc has enabled some OEM’s to eliminate tooling costs altogether!

Your inquiries will receive the prompt attention of our engineering staff. Write **TWIN DISC CLUTCH COMPANY**, Racine, Wisconsin.

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## \*FABROID BEARINGS CUT FRICTION 90%

Under severe helicopter test conditions, Fabroid bearings have gone 60,000,000 cycles *without* failure where all other bearings have failed at 50,000 cycles or less. In actual use Fabroid bearings are performing equally well. Yet Fabroid bearings *never* need lubrication!

Fabroid is a combined fabric of glass and Teflon\* fibers backed by glass cloth impregnated with phenolic. The glass-phenolic system acts as a honeycomb which traps the Teflon and prevents it from cold flowing. The result is a bearing with 1/10th the friction coefficient of lubricated metal bearings.

Fabroid has limitless bearing applications where any or all the following conditions exist: lubrication is impractical; extreme temperatures; tight space or weight conditions; abrading, galling or corrosion; contamination; static friction; shock vibration.

\*E. I. DuPont's Tetrafluorethylene

SEND FOR this informative brochure which fully describes the functional characteristics of Fabroid.



### MICRO-PRECISION DIVISION OF MICROMATIC MONE CORPORATION

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## NEW BOOKS

PICTORIAL HISTORY OF PHILOSOPHY presents more than 3000 years of world philosophy. Reproductions of paintings, statues and artwork beautifully illustrate the volume—the only pages where illustrative material is omitted in the 406-page book are those giving picture credits, acknowledgments and the index. Beginning with a description of Judaism, through such greats, as Buddha, Confucius, Socrates, Plato and Aristotle, the beginning of Christianity, philosophies and philosophers of France, Spain, Italy, Britain, Germany, Russia and America also are included. Written in encyclopedic form, this edition is a valuable reference work for students of philosophy as well as a collector's library item. By Dagobert D. Runes; Philosophical Library, Inc., 15 E. 40th St., New York 16, N.Y.; \$15.

MINIATURIZATION. Actually a compilation of 16 miniaturization problem-fields and their solutions, this book should provide some ideas for various engineering disciplines. It starts with a discussion of miniaturization as a concept by the editor of the book, H. D. Gilbert, president of Miniature Precision Bearings, Inc. Other chapters, written by experts in their fields, discuss miniaturization in military equipment, medicine and computers. Still other chapters discuss such things as preparing the facilities for manufacturing miniaturized products, problems in maintenance and problems in reliability. The book is an extremely timely one in view of the direction being taken by many industries, particularly those concerned with military products. Since it is a collection of essentially 16 different articles, it is somewhat disconnected and there is some duplication of subject matter. The various views of individual authors are, however, of high interest. There are also several reference bibliographies which will prove useful to those intending to go into the subject more deeply. There is much meat here for readers who like to project their thoughts into the future. The last chapter is actually the transcript of a talk given by Dr. Richard Feynman at the California Institute of Technology, which created quite a stir two years ago. As a result of this talk, Dr. Feynman recently awarded a \$1000 prize for building a motor the size of a speck of dust. Reinhold Publishing Corp., 430 Park Ave., New York 22, N.Y.; 306 pages; \$10.



FOR DESIGN,  
PERFORMANCE,  
RELIABILITY...

## LOCKWELL DOUBLE ACTING QUICK RELEASE PINS

As a companion to the Lockwell single-acting quick release pin this NEW double acting pin provides these features which have made Lockwell fasteners the quality line.

**DESIGN** Clean, smooth lines with closed construction eliminating the possibility of dirt collecting in openings.

**PERFORMANCE** Braze construction made economically possible by special equipment allows for higher tension loads and greater versatility.

**RELIABILITY** Positive locking and instant release are provided by simple push-pull action.

Hartwell Lockwell Double Acting Quick Release Pins are available in both 2 ball and 4 ball types with a choice of 3 handle styles. Let us consult with you on special application and design problems.



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**TECHNICAL ILLUSTRATION.** Intended primarily for technical illustration departments, this 8-1/2- by 11-inch, paperbound book is also a good reference for designers interested in techniques for sketching and rendering. Perspective is used in most of the material. Understandably, inking takes up a good portion of the book but some of the hints on using instruments with ink should be of value to designers. By A. D. Pyeatt, Higgins, Co., Inc., 271 Ninth St., Brooklyn 15, N. Y.; 128 pages; \$5.

**INTRODUCTION TO NUCLEAR SCIENCE** is an elementary survey of nuclear science and its impact upon other physical and natural sciences. After a brief review of atomic structure, Alvin Glassner, Argonne National Laboratory, discusses radiation detection methods and known forms of radiation. The nucleus and nuclear reactions are described and accelerators and reactors are surveyed. Considerable space is devoted to the applications of nuclear science, chemistry and biology. The final section of the book comprises a series of 18 experiments, devised and tested by the members of the Argonne staff. Among the experiments are a simple means of determining the ratio charge to mass, a demonstration of radioactive decay, studies of the effects of radiation upon plants and mammals and the use of an iodine tracer. The book is based on a series of courses for high school science teachers on the fundamentals of nuclear science, given at the Argonne National Laboratory Branch of the Scientific Research Society of America. D. Van Nostrand Co., Inc., 120 Alexander St., Princeton, N. J.; 214 pages; \$3.75.

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# VERSATILITY...

## Key Characteristic of ASCO Relays with Time Delay

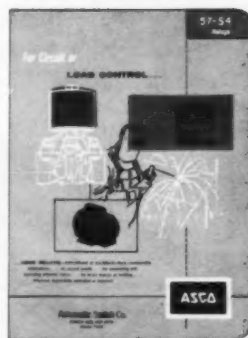
This ASCO Time-Delay Relay, one of the many types of ASCO Relays, is designed for maximal versatility, and is engineered to excel in any service throughout its wide range of applications. Built to control power in large doses, it handles motor loads directly. Delay is screwdriver adjustable from 1½ to 6 seconds on dropout—or can be factory-set to your specifications. Relay arrangements with delay on both pickup and dropout are also available.

ASCO built-in Time Delay with no moving parts can be added to any ASCO Magnetically Held Relay, to 12 poles, 25 amperes. And it's not finicky about actuating power either... you name it and this ASCO relay complies—dc or ac, from 120 to 600 volts, 25 to 2000 cycles.

In all applications involving automatic control, depend on this relay to forestall complications—instability, cycling variations, accelerated contact erosion, hunting of associated relays, or unnecessary shutdowns due to transient conditions—often caused by instantaneously acting relays.

**TYPICAL ASCO EXTRAS** ■ Single-break or double-break silver contacts with wiping action ■ Clapper-type magnet with Oilite bearings at pivot ■ Vacuum impregnated coil ■ Low-loss silicon-steel magnet frame ■ Telephone quality capacitor, to JAN-C-62 and ASCO specifications ■ Selenium rectifiers used conservatively ■ Creepage distance well in excess of NEMA and Underwriters' Laboratory requirements for 600 volts.

Time Delay Relays are only part of the complete ASCO line. Catalog 57-S4 lists magnetically and mechanically held relays to 24 poles, 10 and 25 amperes, along with many specialized types: reverse current, close differential, current-type welding, electronic, and modified arrangements.



Write for your copy today!

## ASCO Electromagnetic Control

**ASCO**

DEPENDABLE CONTROL BY Automatic Switch Co. 56-D HANOVER RD., FLORHAM PARK, N. J. • FRONTIER 7-4000 • AUTOMATIC TRANSFER SWITCHES • SOLENOID VALVES • ELECTROMAGNETIC CONTROL





## New Chassis-Trak Utility Slides Support 15 Times Their Own Weight

Three Models—TILT, TILT-DETENT, and NON-TILT

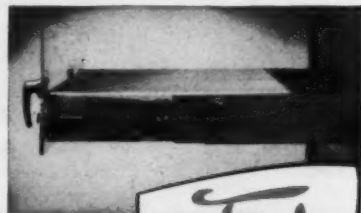
With the introduction of the C-230 Utility Slide, Chassis-Trak can now offer a complete line of electronic cabinet slides in a capacity range from 50 to 275 lbs. The new Utility Slide can be used in any standard rack and in any type of mobile or stationary installation where the chassis load does not exceed 100 lbs.

Chassis-Trak's famous "pencil thin" design is an outstanding advantage of the new C-230. A pair of these fully-extendable slides take up only .620" of usable chassis space—far less than any other slides of equal capacity.

Made of hard, cold-rolled steel, each slide is cadmium plated and then coated with Poxylube 75. This is a bonded film of molybdenum disulfide which provides permanent dry lubrication and protects the metal against solvents, acids and corrosion.

Chassis-Trak C-230 slides are available in seven lengths—12" to 24"—and in a choice of tilt, tilt-detent or non-tilt models. The detent model locks in three positions—90° up, horizontal, and 90° down—for convenience in servicing tube and circuitry sections.

For complete details and specifications on the new C-230 Utility Slide, request Engineering Data Sheet 1600.



**chassis  
Trak  
inc.**

for further information, contact

525 South Webster Avenue, Indianapolis, Indiana

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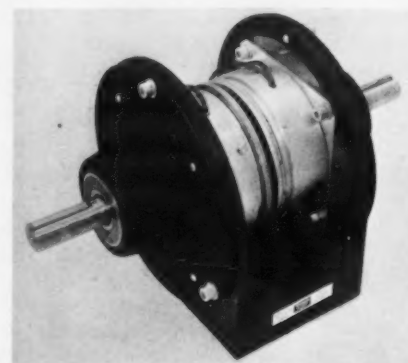
## DESIGN IDEAS IN THE NEWS NEWS

### Electric Clutch-Brake Package Uses Flange-Mounted Components

A fractional-horsepower clutch-brake package uses a bolted, flanged assembly for ease in mounting and for accurate alignment of standard clutch and brake components.

The Warner Electric Brake & Clutch Co., Beloit, Wis., has devised a cast mounting bracket with two flanged outboard bearing housings, piloted to pre-align components frequently combined to form an integrated duty-cycle drive. Clutch and brake fields (also flanged) each are bolted to a bearing housing, and the bearing housings then are fastened by three screws each to opposite ends of the prebored mounting bracket. A common splined armature hub interconnects the otherwise conventional clutch and brake.

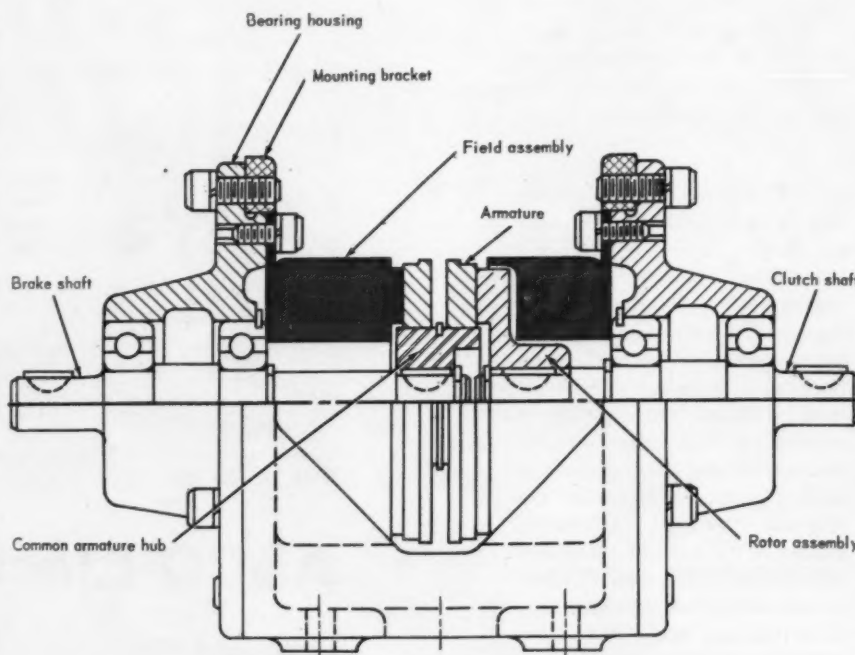
Primary advantage of this unit, when used in other machinery, is that it can be installed with little or no machining. The outboard bearings are away from heat

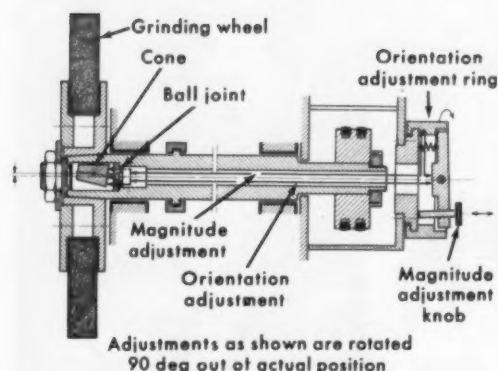


and are well spread to take care of side loads of chain, V-belt or gear drives. The package is open for maximum heat dissipation although covers are available if needed. Assembly and disassembly are simple without loss of alignment.

The Electro-Pack clutch-brake package is currently available in 10, 60, 240 in.-lb units.

L.G.S.





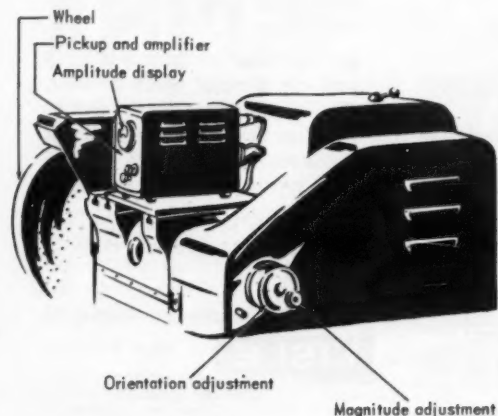
• **CONICAL COUNTERWEIGHT** with externally adjustable tilt angle away from the spindle axis permits dynamic balancing of a grinding wheel while the spindle is rotating. Amplitudes caused by off-balance running can be cut down to 0.0001 mm, even if wheel unbalance changes in operation because of continuing absorption of cooling fluid.

Inside the wheel-seating cone, a balancing cone is mounted in a spherical joint. Orientation and magnitude of cone tilt away from the spindle axis are independently adjustable through linkages which run through the hollow spindle and terminate in manual controls.

Vibrations are transmitted mechanically through the rigid grinder housing, are electronically sensed and amplified, and are displayed on a graduated scale. The amplifier is tunable to the spindle rpm; this filters out extraneous vibrations not attributable to wheel unbalance. Cone tilt is changed by trial-and-error until vibration amplitude is at minimum.

The "Finibalanx" unit is a product of Fortuna-Werke Spezialmaschinenfabrik KG., Stuttgart, Germany.

R.F.S.



## Introducing a new type of "Armalon"

### new "Armalon" FEP-fluorocarbon resin coated glass fabrics

After extensive development and testing, Du Pont now can offer "Armalon" FEP-fluorocarbon resin coated glass fabrics. The FEP resin has unique properties that enable this new "Armalon" to find applications in areas not appropriate to our regular TFE line of "Armalon".

#### Outstanding advantages of new "Armalon" FEP

- Uniform porosity resistance
- New lower melt point for easier lamination
- Good heat resistance
- Extreme toughness
- Abrasion resistance
- Excellent electrical properties over a wide range of temperatures and frequencies
- High degree of chemical inertness
- Smooth, anti-adhesive surface with anti-stick qualities

#### Comparison of properties of new "Armalon" FEP and "Armalon" TFE

PROPERTIES	FEP 503-108	TFE 403-108	FEP 505-112	TFE 405-112	FEP 506A-116	TFE 406A-116	FEP 510-128	TFE 410-128
Breaking Strength	65 x 40	45 x 35	130 x 65	75 x 60	160 x 160	90 x 90	260 x 220	200 x 175
Tear (Elmendorf)	16 x 6	10 x 5	21 x 8	15 x 10	13 x 14	12 x 12	49 x 39	40 x 40
Moisture Absorption	.23	.64	.18	.68	.30	.32	.276	.10
Burst	150	25	200	25	380	100	410	100

#### Characteristics of new "Armalon" FEP

The "Teflon" FEP-fluorocarbon resin coating on "Armalon" FEP gives this new material several outstanding properties (not provided by "Armalon" TFE). For example, the FEP resin has a lower melt point (545°F. to 563°F.) than the TFE resin. This recommends the use of "Armalon" FEP as a coating on glass fabrics that are to be heat-sealed. In addition, FEP dispersion-

coated glass fabrics have lower permeability, greater breaking strength and lower moisture absorption than "Armalon" TFE.

You may want a material that doesn't crack when creased under moderate pressure. "Armalon" FEP won't. There is no known solvent for its FEP resin coating, and it is unaffected by aqua regia and all known chemicals except

molten alkali metals. Corrosive materials and atmospheric conditions have no effect on it.

"Armalon" FEP remains flexible after long exposure to high temperatures, and pliable at temperatures lower than -100°F. Of particular significance are the improvements in burst strength and moisture absorption in the higher resin, lower glass qualities (see Qualities 503-108 and 505-112).

#### Suggested uses for new "Armalon" FEP

An important use for new "Armalon" FEP is in the wrapping and fusing operations for pipe covering, roll covering and chemically resistant containers. We also recommend these new materials for gaskets and specialized diaphragms, because of their satisfactory levels of uniform porosity resistance.

Industries that should find new "Armalon" FEP useful are aircraft, chemical, food processing, packaging, paper, plastics, printing, rubber, textile and various other industries.

FOR EXAMPLE: Conveyor belts used in baking, candy and food industries where sanitation and ease of release are important—Non-sticking covers for heat-sealing bars on packaging equipment—Diaphragms for regulators and control instruments where heat and chemical resistance are required. These are a few suggested uses for new "Armalon" FEP—there are many, many more. What application does this new product suggest to you?

For complete information on new "Armalon" FEP, its application and uses, write:  
E. I. du Pont de Nemours & Co. (Inc.), Fabric Sales, Wilmington 98, Delaware.



BETTER THINGS FOR BETTER LIVING... THROUGH CHEMISTRY

## "ARMALON" COATED GLASS FABRICS

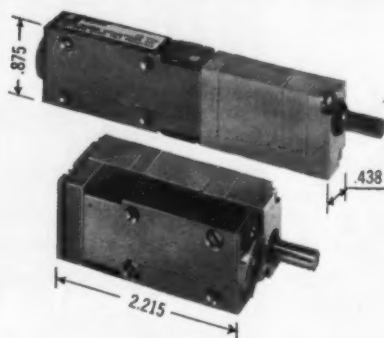
"Armalon" is Du Pont's trademark for its FEP and TFE fluorocarbon resin-coated fabrics and laminates.

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## NEW FLAT GEARMOTORS

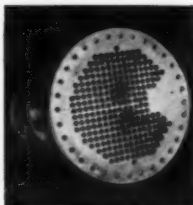
most compact / most torque

Globe Type VS d.c. gearmotors give up to 70 oz. in. torque (35 oz. in. continuous duty) in two packages, one with a frontal area as small as 0.4 sq. in. Motor develops .0025 hp in the 8,000 to 17,000 rpm range; many standard armatures, 3 to 50 v.d.c. End mounted gearbox: 62 standard ratios from 7.88:1 to 25,573.65:1. Side mounted gearbox: 27 standard ratios. Case hardened gears. Units designed to meet MIL specs. Bulletin VSG. Globe Industries, Inc., 1784 Stanley Avenue, Dayton 4, Ohio.



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The high strength and positive elastic limit of AMPCO metal make possible important weight-savings in tube sheets like this.



# SAVE WEIGHT USE AMPCO<sup>®</sup> metal

A series of special copper-base alloys having unusually high tensile and yield strengths, compared with other non-ferrous metals—yet weighing 10-15% less. You can use lighter sections — save materials and money. Send for Bulletin G-60. It's free!



AMPCO METAL, INC. DEPT. 40-J, MILWAUKEE 1, WIS.  
West Coast Div.: Huntington Park, Calif. • Southwest Div.: Garland (Dallas Co.), Tex.

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• **ULTRASONIC WAVES** have been amplified directly in a piezoelectric semiconductor crystal by Bell Telephone Laboratories scientists. The sound waves are amplified by interaction with electrons drifting in the crystal.

The amount of amplification obtained depends on the applied voltage and the conductivity of the material. Cadmium sulfide was used in the experiment because large single crystals are available which are strongly piezoelectric and have the required semiconducting properties.

Direct amplification of high-frequency sound waves is possible because a sound wave traveling in a piezoelectric material produces a longitudinal electric field which travels along with the wave. If the material is also conductive, the electric field will cause currents to flow in the material. Because the piezoelectric field is periodic, the electrons bunch together in parts of the ultrasonic wave. The bunched electrons tend to interact with the piezoelectric field and consequently react back on the material, changing the velocity and amplitude of the sound wave.

If a d-c electric field is impressed on the material, so that the bunched carriers are made to drift in the direction of wave propagation faster than the speed of sound, the sound wave will be amplified similarly to the way electromagnetic waves are amplified in a traveling-wave tube. Gains of 18 db in a 15-mc wave and 38 db in a 45-mc wave traveling through a 7-mm length of CdS were observed.

## HOW TO SELECT FLEXIBLE SHAFTING FOR POWER DRIVE APPLICATIONS



1 1/4-inch STOW Power Drive flexible shaft with core assembly pulled out of casing.

For Power Drive applications, the following factors must be considered:

1. **Torque (Lb. In.)** to be transmitted. (The starting torque should be used in making selections.)

2. **Operating Speeds (RPM)**—If the maximum speed is higher than the rated speed, torque ratings in the table below do not apply. To find the torque capacity for flexible shafts operating at speeds higher than the rated speeds, multiply the maximum dynamic torque capacity by the rated speed, and then divide by the operating speed. (See example.)

3. **Operating Radius**—In making the selection from the table below, the radius of the smallest bend in the flexible shaft should be used.

**Ratings**—The ratings for flexible shafts shown in the table below apply under the following conditions:

1. When the flexible shaft is adequately supported by clamps along its length. (For unsupported shafts, multiply the calculated torque by a safety factor of 1.6—see example below.)

2. When the flexible shaft is operated in the wind-up direction, which tends to tighten the outer layer of wires. (Flexible shafts operated in the unwind direction will transmit only about 60% of the rated torque.)

3. When the flexible shaft is in continuous operation. (Note: the ratings are based on temperature rise. When the operation is intermittent, the ratings in the table may be exceeded. Consult Stow engineers for specific recommendations.)

RATED SPEED R.P.M.	MAXIMUM DYNAMIC TORQUE CAPACITY (LB. IN.)										Wgt./ C. Ft.	Core Dia.	Core No. and Type	Shaft Size
	STRAIGHT AND CURVED SHAFTS													
	RADIUS OF CURVATURE IN INCHES													
	50 to start.	25	20	15	12	10	8	6	5					
4,500	2.4	2.2	2.0	2.0	1.92	1.9	1.7	1.5	1.25	3.0	.124/.128	2049 MH	13	
3,800	7.0	6.4	6.0	5.8	5.4	5.0	4.6	3.6	2.0	4.5	.148/.152	2081 MH	15	
2,900	9.4	8.6	8.0	7.6	7.0	6.6	6.0	4.8	3.4	7.0	.185/.189	3108 MH	19	
2,500	22.0	20.0	18.8	17.6	16.0	15.0	12.6	10.8	9.0	12.5	.247/.252	8924 MH	25	
1,800	30.0	28.0	26.4	25.0	23.0	21.0	18.0	14.0		20.0	.308/.313	8925 MH	31	
1,800	33.8	31.5	29.7	28.1	25.9	23.6	20.2	15.8		20.0	.308/.313	8949 T	31	
1,800	36.0	33.0	31.6	30.0	28.0	26.0	22.0	18.0	11.0	21.0	.324/.329	2034 A	31	
1,500	80.0	66.0	63.0	58.0	51.0	46.0	37.0	22.0		28.5	.368/.374	2035 A	38	
1,500	60.0	54.0	50.0	46.0	42.0	38.0	30.0	24.0		29.0	.387/.393	8970 MH	40	
1,500	90.0	81.0	75.0	69.0	63.0	57.0	45.0	36.0		29.0	.387/.393	8971 T	40	
1,150	136.0	110.0	104.0	94.0	80.0	72.0	56.0			50.5	.497/.503	8999 A	50	
1,150	148	124	110	92	72	56				53.5	.505/.511	6940 T	50	
900	248	200	176	124	84					78.5	.610/.618	6997 T	63	
900	220	204	192	180	152	130				80.5	.630/.638	7731 A	63	
750	340	224	156	76						117	.747/.753	2056 T	75	
600	760	520	420							205	.998/1.004	2057 T	100	
440	1,500	720								343	1.298/1.304	2058 T	125	

EXAMPLE — How to use the table:  
The problem is to transmit 1/2 HP at 1700 RPM through an unsupported flexible shaft in a 25" radius, estimated starting torque 150% of normal operating torque.

1. Calc. Torque (lb. in.) —  
$$\frac{HP \times 63000}{RPM} = \frac{.5 \times 63000}{1700} = 18.5$$

2. Correction factor for starting torque:  
 $1.5 \times 18.5 = 27.75$

3. Correction factor for unsupported shaft 27.75 x 1.6 = 44.4 lb. in.

4. Refer to Table above. Read downward in column under 25" radius until you find a core having a rating of at least 44.4 lb. in. In this case we find that core No. 8970 is rated 54 lb. in. at 1500 RPM. Since the given speed is 1700 RPM, multiply 54 by 1500 and divide by 1700.  $54 \times 1500 \div 1700 = 47.6$  lb. in. (rated torque at 1700 RPM). Therefore, Core No. 8970 is correct.



For Engineering Bulletin No. 570 and a free torque calculator, write

**MANUFACTURING CO.**

308 Shear Street • Binghamton, New York

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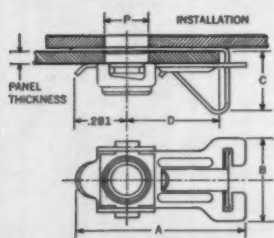
assembly procedure:

## PUSH...CLICK...IT'S IN!

Two fingers and two seconds—that's all it takes to install a Shur-Lok Clip Nut. What can it do for you? Simply this: you can now have a plate nut which requires neither rivets nor installation tools!

The really unique feature of the Shur-Lok Clip Nut is the spring-loaded nut retainer which makes each nut suitable to a whole range of sheet metal gauges. Lightweight Shur-Lok Clip Nuts will always lie flat after they are snapped into place. How can you beat *this* for simplicity?

Check these specifications—then write for prices and additional information.



NOTE: Panel misalignment may be accommodated by increasing "P" hole diameter within specified limits.



A small access hole and a Shur-Lok Clip Nut solve panel interior mounting problems, too!

\*Thread locking feature conforms to MIL-N-25027.

SHUR-LOK PART NUMBER	THREAD SIZE CLASS 3B*	PANEL THICKNESS RANGE	A	B	C	D	P SEE NOTE	APPROX. WEIGHT LBS./100
SL88-632-38-09	6-32NC	.020-.090	.76	.38	.21	.25-.38	.163-.203	.40
SL88-632-50-09	6-32NC	.020-.090	.87	.38	.21	.31-.50	.163-.203	.41
SL88-832-38-09	8-32NC	.020-.090	.76	.38	.21	.25-.38	.189-.229	.40
SL88-832-50-09	8-32NC	.020-.090	.87	.38	.21	.31-.50	.189-.229	.41
SL88-832-50-15	8-32NC	.020-.150	.87	.44	.30	.35-.50	.189-.229	.42
SL88-832-65-15	8-32NC	.020-.150	1.03	.44	.30	.50-.65	.189-.229	.43
SL88-1032-38-09	10-32NF	.020-.090	.76	.44	.21	.25-.38	.218-.261	.53
SL88-1032-50-15	10-32NF	.020-.150	.87	.44	.30	.35-.50	.218-.261	.55
SL88-1032-65-15	10-32NF	.020-.150	1.03	.44	.30	.50-.65	.218-.261	.57

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## IDEAS IN THE NEWS

• **DEVELOPING A 221-CU-IN V-8 ENGINE**, the Ford Motor Co. has taken advantage of the latest manufacturing and foundry techniques to achieve a substantial weight reduction without loss of structural rigidity.

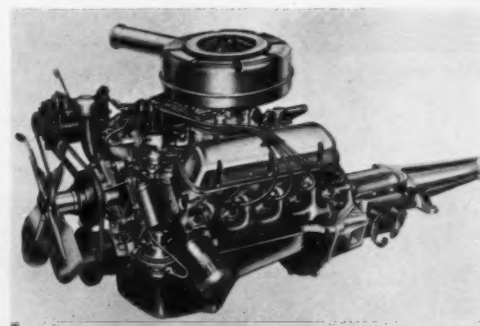
The block and all major components are of cast-alloy iron. In molding, a thin-wall technique is used in which the "core box" is preheated and a new processed combination of sand and plastic (resin) binder is blown in under pressure. The binder fuses and quickly sets to form a firm core, ready for use in molding.

Formerly, the blown-in core was transported to drying ovens to be "baked" (fusing the binder and forming the core). The new technique eliminates the potential damage of distorting or warping the new core and allows the molding of thinner engine walls of precise, uniform casting thickness.

The cylinder block incorporates a short-skirt configuration for maximum weight reduction with compact structural rigidity. The cast-iron cylinder heads incorporate a wedge-type combustion chamber, located centrally over the bore.

The valve train has stud-mounted rocker arms which eliminate the complexity of the rocker arm shaft. The arms themselves are cast from malleable iron which serves as a sound deadner and also has desirable lubricant-retaining properties.

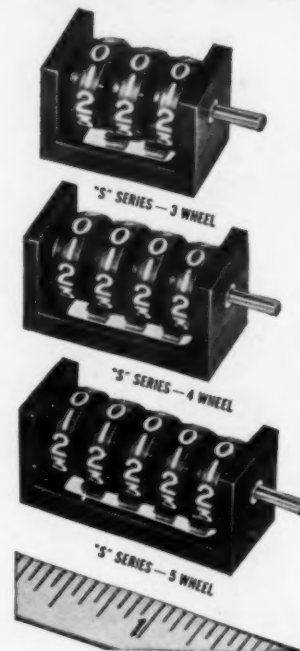
This engine will be used in the 62 Fairlane, manufactured by the Ford Division of Ford Motor Co. An engine of similar design will be used in the 62 Meteor manufactured by the Lincoln-Mercury Div.



**221-CU-IN V-8 ENGINE** with manual transmission. OHV design employs exhaust-heated induction system and external counterweight balance arrangement. Balance sectors are incorporated in bolt-on, sheet-metal front pulley and on flywheel. Placing counterweights at crankshaft extremities, where effect is greatest, permits use of less mass in counterweights.

## DURANT

**1" wheel COMPACT DIGITAL READ-OUT COUNTERS**



- Sub-miniature additions to the popular "Y" and "D" Series
- High speed range—low torque
- Black wheels, white figures. Other colors available
- Right or left hand drive — either direction
- 3, 4, and 5 figure counters are standard. Additional figures and special combinations available
- Direct drive to unit wheel. Ten counts to one revolution of the drive shaft
- Zamak die cast one-piece frame
- -60°C to +85°C temperature range. Meet most military specifications

Your answer to an infinite number of variable demands for **PRECISION READ-OUT**.

Send for Catalog No. 400

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**DURANT**  
COUNTING INSTRUMENTS

REPRESENTATIVES IN PRINCIPAL CITIES  
Circle 102 on Reader-Service Card



## Specialty PAPERS

### The **X** That Solves BOTHERSOME COST AND DESIGN PROBLEMS

The economy, lightness, uniformity and availability of paper has long been known. But as the X factor in today's cost and design problems, specialty papers open up possibilities hitherto undreamed.

Back in 1940 — after 132 years in the paper business—Knowlton Brothers developed a paper now used in nearly every automobile, airplane and laboratory. That's when we decided to make special papers for special uses.

#### We're Doing It.

In our research laboratory, equipped with everything from nucleonic and radioactive monitors to a 20-inch web Fourdrinier paper machine, top-ranking chemists, physicists and paper specialists are turning out unusual papers that are finding unusual uses in modern industry and defense.

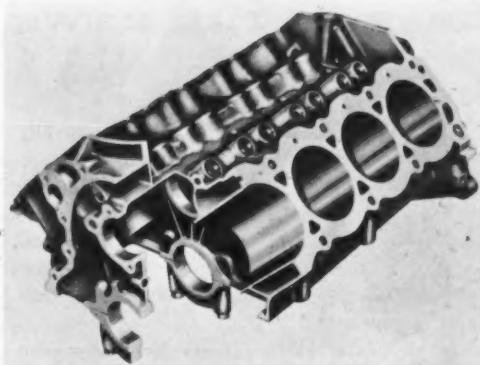
We still turn out production runs, but only of specialty papers requiring extremely close dimensional, chemical or physical limits and uniformity. Our major interest is the creation or re-combination of physical, chemical, electrical, molecular, reticular and comparable properties that will enable new papers to serve new and wider uses.

#### Do You Have Such a Use?

Write for our free booklet "Creative Imagination in Technical Papers." Or tell us what you want paper to do. If it sounds reasonably attainable, a sales engineer will call.



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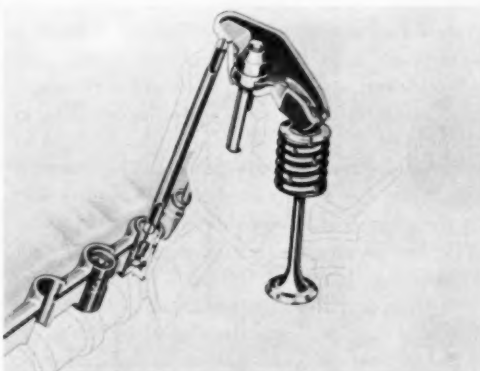


CYLINDER BLOCK is produced by version of shell-molding process which provides lightweight, thin-wall cast-iron construction for durability and rigidity.

#### ENGINE DATA:

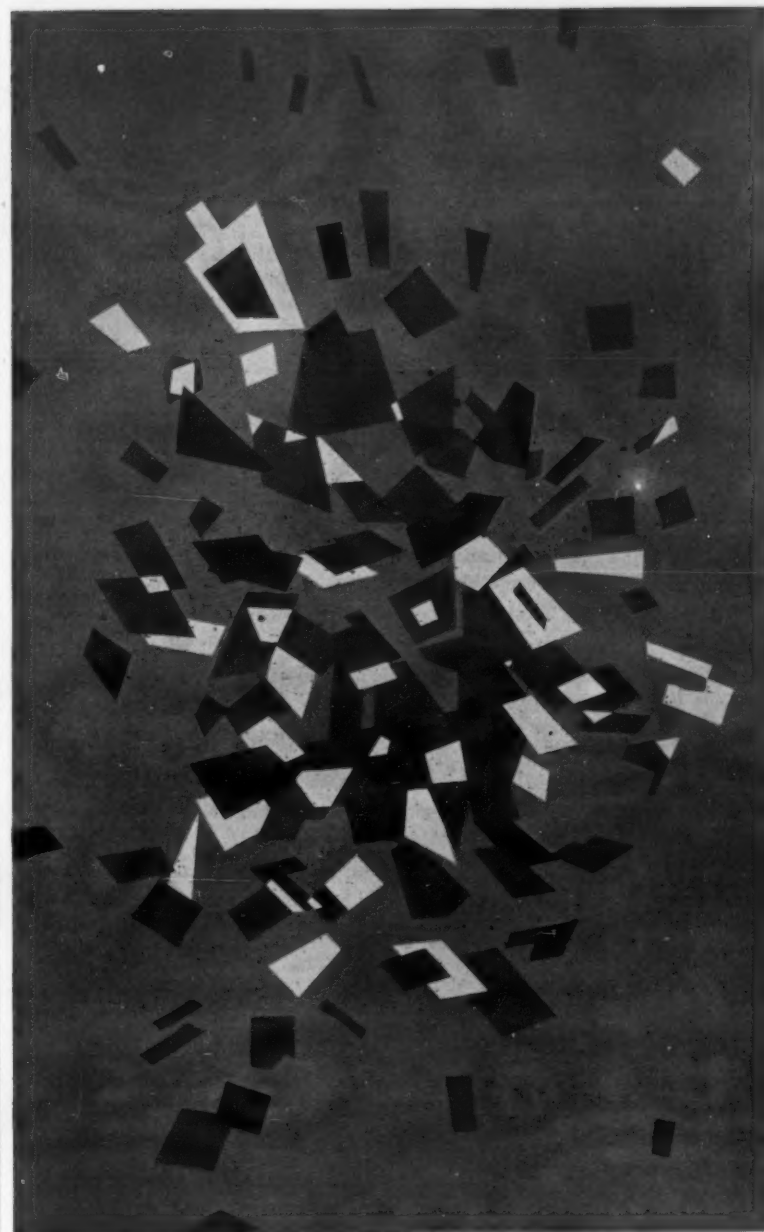
Bore and Stroke	3.50 x 2.87
Carburetor	2 Venturi
Displacement	221 cu in
Max. BHP @ rpm	143 @ 4500
Max. Torque @ rpm	217 @ 2200
Compression Ratio	8.5:1

E.J.S.



VALVE ARRANGEMENT uses stud-mounted malleable iron rocker arms. Valves are actuated by hydraulic lifters. Rocker arms are lubricated from hydraulic lifter through hollow push rods.

• **TESTS** on microscopic live specimens, exposed to the vacuum of space in a recent study at Hughes Aircraft Co., show that all specimens died after 20 days of "space travel". Experiments with a number of common microorganisms have shown that vacuum alone will kill bacteria and fungi, provided that pressures are low enough and exposure is prolonged sufficiently. The evidence indicates that unprotected spores cannot carry life from one planet to another and that the costly practice of sterilizing exterior surfaces of space vehicles may be unnecessary.



## SHOCK AND VIBRATION PROBLEMS?

CONTACT THE SPECIALISTS:

**BARRY CONTROLS**

Division of Barry Wright Corporation



700 PLEASANT ST., WATERTOWN 72, MASS.

1400 FLOWER ST., GLENDALE, CALIF.

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## Compare Index Units! FERGUSON "PROVES OUT" ... Point by Point.

Selection of components for a production machine should be based upon the machine's return per dollar investment. Matching "first costs" only does not generally result in the design of profitably operated equipment.

**Here is a check list** for comparison of indexing mechanisms. "Price" is shown in its order of consideration.

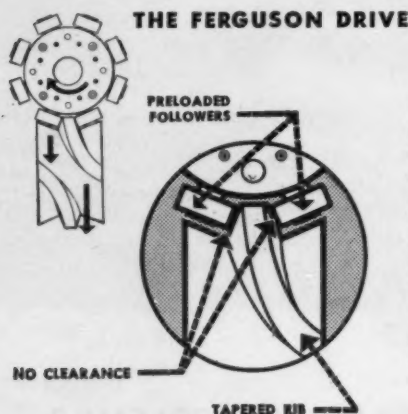
**1. BACKLASH**—None? Some during the dwell or index or both? Any backlash during any part of the cycle results in wear-causing vibrations and shock loads... *The Ferguson Drive maintains zero backlash at all times.*

**2. RATED LOADS**—What is the rated life and under what load? What is the average follower life (B-10 life)? The Ferguson Drive is rated at maximum precision for at least 8,000 hours operation and with an average follower life of 90%. Replacement of the followers renews the life of the Drive for another 8,000 hours. Ferguson cams never wear out under rated loads.

**3. JOB SUITABILITY**—Can the acceleration characteristic be pre-selected according to job requirements or is it inherent in the mechanism or limited by the manufacturer? Acceleration of the Ferguson Drive can be chosen after an application evaluation to provide optimum operation.

**4. INDEXING ACCURACY**—Are time-consuming shot pins necessary for precision?... They soon wear and lose accuracy. The Ferguson Drive is positive locking and locating for extreme precision without shot pins.

**5. FIRST COST vs. TOTAL COST**—Now consider the higher production rates, better quality and much lower maintenance costs the Ferguson Drive gives you. Determine the *total cost* of the various indexing mechanisms. The Ferguson Drive has proved out... And you're on the way to building more profitable production equipment.



Cam features a tapered rib along which two standard cylindrical followers roll without clearance... maintaining zero backlash during index and dwell. While in the dwell or "work" position a straight portion of the cam rib locks the hub positively, without auxiliary locating or locking devices. *Extreme precision is inherent*, even at speeds as high as 2,000 indexes a minute!

**CATALOG NO. 161** gives complete design data on nearly 100 standard indexing mechanisms, over 150 index

tables and various auxiliary items: Send for your free copy... There's one for every design engineer.



**FERGUSON  
MACHINE COMPANY**

*A Division of Universal Match Corporation*

7818 Maplewood Court

St. Louis 17, Missouri

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## IDEAS IN THE NEWS

• **"MOLECULAR SLIDE RULE"** electronically performs multiplication and division by a process similar to that used in the mechanical slide rule. However, the new multiplier-divider has no conventional electronic components or circuitry. It consists of a solid slice of silicon about the size of the head of a thumb tack and as thick as a few sheets of paper.

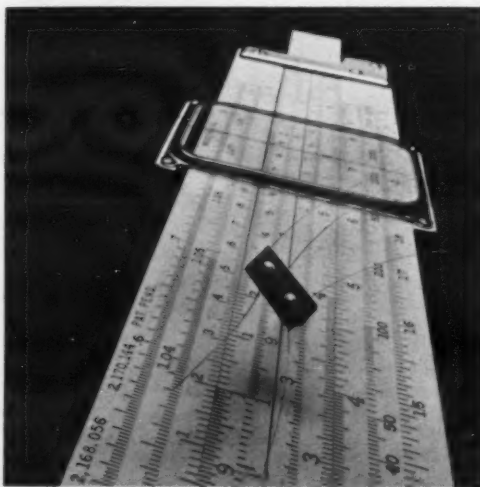
The molecular slide rule performs by rearranging the internal structure of a solid semiconductor crystal. Electronic behavior occurring within or between regions in the crystal gives the same effect as an entire electronic circuit (subsystem), or even a whole system.

The multiplying and dividing performed by the functional block are equivalent to that done by an array of four separate diodes, or three diodes and a transistor.

The electronic block multiplies by adding together voltages that are logarithms of the quantities to be multiplied. An electric current fed into a junction gives a voltage across the junction proportional to the logarithm of the current. An input of two currents into two junctions gives a voltage which is their logarithmic sum. The antilogarithm, measured at the output of the functional block, is the product of multiplying them together.

Division is the opposite process. The currents are fed into the multiplier-divider in such a way that their two logarithms subtract instead of add.

The new device has an input range of 10 to 1 and an output range of 100 to 1. Its accuracy in multiplying and dividing is within 5 percent. The molecular slide rule was developed by scientists at the Westinghouse Research Laboratories.



high  
performance

small  
size

**FIKE**

custom made rupture units  
relieve overpressure —  
act as quick opening valve



Fike custom rupture units are ideal where space, weight or special installation problems are encountered. The rupture unit will relieve overpressure or act as a quick opening valve by rupturing precision made metal rupture discs at a predetermined pressure.

Units  $\frac{3}{8}$ " to  $1\frac{1}{2}$ " in diameter with  $\frac{1}{8}$ " to  $1$ " rupture discs are illustrated above. Depending on the application, rupture pressures of 200 to 10,000 PSIG are possible.

Other special assemblies can be provided for a specific requirement. We welcome inquiries on special and unusual applications.

**Fike**

**METAL PRODUCTS CORP.**

Dept. DN

Blue Springs, Missouri

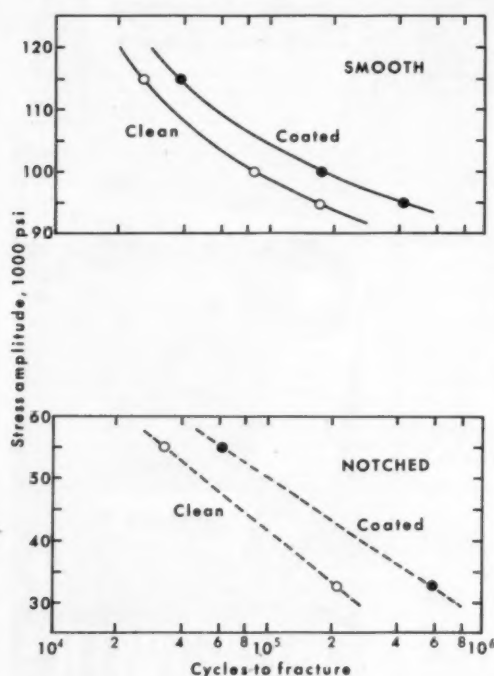
Circle 106 on Reader-Service Card

• **RATE OF FATIGUE CRACK PROPAGATION** through a metal specimen is reduced significantly by the presence of an organic liquid such as dodecyl alcohol on the test section. Application of this liquid to the surfaces of steel, stainless steel, aluminum and copper-beryllium alloy specimens increases the number of cycles required to propagate cracks by factors ranging from 1.4 in the stainless steel to 5.0 in the copper-beryllium alloy.

The coating, by limiting the access of molecules of oxygen or water to the metal surface, reduces the rate of detrimental surface reactions that normally occur when specimens are stressed in air. Prior to crack initiation, the film minimizes these reactions. During the crack-propagation phase, however, each increment of crack extension provides an area of clean metal surface that may react with any oxygen in the atmosphere.

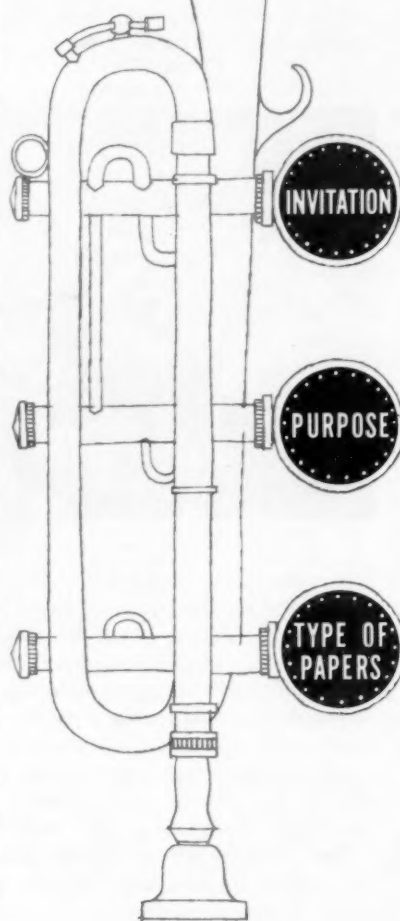
The mechanism of the effect of surface reactions on fatigue is still not clear. Recent research tends to show that the oxygen and the water vapor in the atmosphere are responsible for the reduction of fatigue life.

The evaluation of the effect of dodecyl alcohol on the rate of fatigue crack propagation was made by the National Bureau of Standards.



CURVES, based on studies of metal fatigue on both smooth and notched specimens of 4340 steel, show that specimens coated with dodecyl alcohol compound have increased fatigue strength.

call for  
Papers



Send  
your  
proposed  
Paper to:

(IN TRIPLICATE)

## 3<sup>rd</sup> INTERNATIONAL ELECTRONIC CIRCUIT PACKAGING SYMPOSIUM

You are invited to submit a paper for presentation at the Third Symposium on Electronic Packaging Techniques, sponsored by the University of Colorado, EDN (Electrical Design News), and Design News. The meeting will be held August 15-16-17, 1962 on the campus of the University of Colorado in Boulder, Colorado, the week preceding the Wescon Show in Los Angeles.

This is a noncommercial, technical education program geared specifically to engineers in all phases of electrical and electronic circuit packaging. Selection of each paper will be determined by the range of its subject matter and its contribution to circuit packaging. Areas covered will extend from the microscopic to the macroscopic, with special emphasis on packaging materials, packaging for outerspace, packaging for appearance, underground and underwater packaging, interconnections in packaging, and packaging economics.

General papers covering overall packaging concepts as well as papers dealing with specific designs are desired. Titles of proposed papers accompanied by individual explanations of about 500 words generally outlining the subject matter are requested at this time. Such an indication of a possible paper to be submitted will not place the author under any obligation, but will be helpful to the committee in planning the technical program.

A formal "Proceedings" of the Symposium will be published.

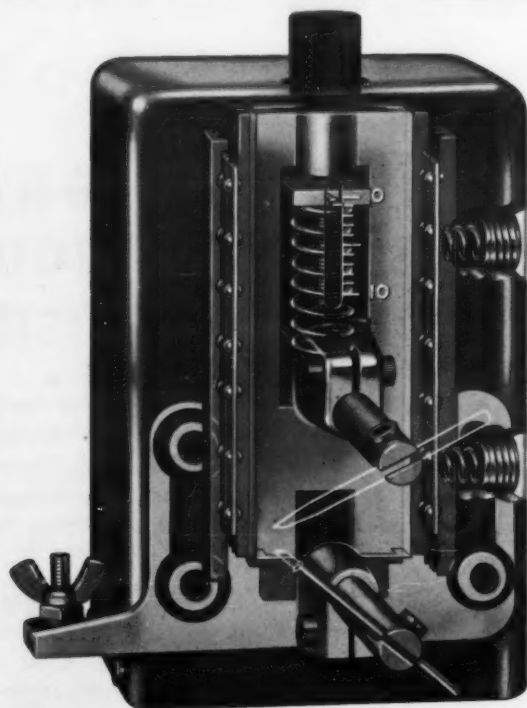
**DEADLINE:** THE FINAL DATE AFTER WHICH PAPERS CAN NOT BE CONSIDERED IS JANUARY 10, 1962.

MR. GERALD A. WALKER  
ROGERS PUBLISHING COMPANY  
3375 S. BANNOCK ST.  
ENGLEWOOD, COLORADO





## THIS WELDMATIC WELDING HEAD IS USED TO PRODUCE MORE MODULES THAN ALL OTHER MAKES combined



### Here's why—

#### Fastest Follow-Up

Model 1032 combines (1) near-zero inertia of lightweight electrode arm with (2) minimum friction (thanks to self-adjusting spring loaded linear raceways) and (3) low spring-rate driving force, to supply *ultimate* acceleration capability throughout the weld formation period. The vital combination of these 3 factors determines the resultant Weld-Schedule optimum "maximum-strength" area.

#### Absolute Linear Electrode Movement

Long linear ball-bearing raceways allow only perfect, non-wiping action—wiping action being a major contributor to mediocre welds.

#### True Force Firing

Patented, pure force-firing action is designed into the Model 1032. Weld energy is released to the electrodes only—and exactly—when the preset force is reached, regardless of setup configuration.

#### Self-Adjusting Raceways

Dual, linear ball-bearing raceways,

spring loaded for full compliance, compensate for wear, thermal effects, and normal dirt and provide absolute, lowest constant friction over full electrode arm stroke.

#### Minimum Movable Mass

All parts moving during follow-up total less than 4 ozs. Die-cast electrode arm and holder, with electroplated high conductivity interfaces, offer highest welding efficiency yet lowest mass.

#### Full Flexibility and Accessibility

The head features full frontal 3-dimensional access with fully adjustable arm lengths. The head operates at any desired work position, either singly or in double head combinations.

#### Full Line of Tailored Accessories Available

Optimum production weld repeatability results through minimizing operator fatigue. Tailored accessories such as actuators, illuminator, magnifiers, riser assembly, horizontal adaptor, etc., provide these results.

For detailed specifications write:

**WELDMATIC DIVISION / UNITEK**

950 ROYAL OAKS DRIVE, MONROVIA, CALIFORNIA

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## IDEAS IN THE NEWS

• **AUTOMATIC LANDING SYSTEM** will guide unpowered space vehicles and reusable first-stage booster missiles for a normal landing. The system, using a computer and radio commands for guidance, will be applicable either to returning space vehicles or to recovery systems now being devised for return and reuse of missiles used to boost satellites and spacecraft into space.

Radar will create a "window" in the vehicle's line of flight. The window will be 7 miles high and 60 miles wide. After the vehicle re-enters the atmosphere, it will fly through this window and will be in direct communication with the landing system equipment on the ground.



A series of safe flight paths will be calculated and stored on the computer beforehand. When the space vehicle is about 500 miles from the landing site, a beacon aboard it will send a radio signal which will be picked up by the radar. From information supplied by the radar and the airborne beacon, the computer will know the vehicle's position and velocity. The computer then will be able to select the precise flight path which avoids overheating or overstress of the vehicle.

The computer will generate a guidance command which the radar will send to the beacon. The guidance command either will be relayed to the vehicle's autopilot or, in the case of a manned vehicle, the command signal will be displayed on a scope for the pilot. By continually repeating the sequence, the landing system will bring the vehicle in at about 70 mph.

Total weight of the airborne system, including an antenna, will be about 28 lb. The automatic landing system is under development by General Electric's Defense Systems Dept.

maintains  
user preference  
for...  
**YOUR PRODUCT**

Palmetto®  
**PYRAMID®**  
V-PACKING



Pyramid protects the reputation of your hydraulic or pneumatic equipment with packing that gives long-lived, trouble-free service. Its advanced design remains dependably leak-free at all pressures; its proved construction features stronger walls and hinge area molded of endlessly folded fabric—which cannot fray and clog the hydraulic system. Pyramid rings have uniformly sharp sealing lips.

Curved lips and single lines of contact permit each ring to flex independently in response to pressure changes.



**NEW SEALSAVER®  
ADAPTER RINGS  
FOR PYRAMID**

Palmetto's "SealSaver" adapters outperform all other types. They combine the strength of reinforced plastics with the unique ability, under pressure, to close the entire piston or rod clearance and completely eliminate extrusion.

**PALMETTO  
PACKINGS**

Write for Details Now

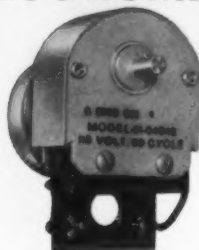
**GREENE, TWEED & CO.**

OUR 99TH YEAR  
NORTH WALES, PA.

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## ECONOMICAL PROCESS CONTROL



Model 81  
For mounting at rear of customer's panel.  
(Also available with dial and pointer for front panel mounting.)

### with Hagen single circuit motor reset timers

This versatile, cost-saving timer is used for controlling a process or series of processes to be operated for a selected interval and then shut off automatically.

- **TIMING OPERATION** starts when external contact is closed; remains for duration of cycle.
- **UNIQUE MOUNTING** of Reset Spring provides uniform tension throughout timing scale, for long spring life.
- **MOTOR IS PROTECTED** by over-ride, slip-clutch assembly when timers remain in "timed-out" position while motor coil is energized.

ADJUSTABLE TIME SETTINGS . . . CONTACT RATING: 15 Amperes 125/250 DIAL SPREAD: 225 Degrees . . . UNIT AVAILABLE WITH OR WITHOUT CALIBRATED DIAL AND POINTER.

Send for HAGEN Bulletin 1610



**HAGEN MANUFACTURING COMPANY**  
BARABOO, WISC.

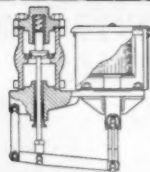
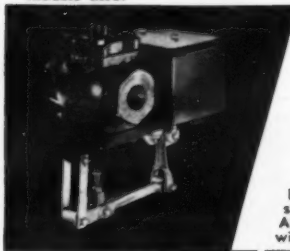
A DIVISION OF THE CATERPILLAR COMPANY AN E. W. BLISS COMPANY SUBSIDIARY

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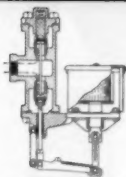
## BIG LINE-UP BIG PERFORMANCE

Johnson Solenoid Valves are built for heavy duty service . . . handling, air, water, steam, heavy viscous liquids. No pilots or pistons; powerful leverage design opens smaller valves against 250 lbs. Because of the remoteness of the solenoid, temperatures up to 400° F. are easily handled without adverse effect on the solenoid coil. Bodies are bolted together. Explosion-proof models also.

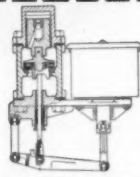
## JOHNSON Direct Operated SOLENOID VALVES



Normally closed service, stainless steel valve and seat. Sizes 3/8"-3". Also for normally open service, and with Jenkins Disc.



3-way valve. Stainless steel valves and seats. Sizes 1/2"-1 1/2".



Dashpot construction, cushions closing to avoid water hammer. Jenkins Disc. Sizes 3/4"-2".

Write for Bulletin "V"



**THE JOHNSON CORPORATION**

831 Wood St., Three Rivers, Mich.

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• **SUPERCONDUCTING, "SUPER" MAGNET**, the size of a doughnut and weighing only 1 lb, creates a magnetic field twice as strong as that from a conventional iron-core electro-magnet, weighing 40,000 lb and operated to saturation of the iron. The new magnet runs from an ordinary automobile storage battery. The only power the battery continuously supplies is a few watts to overcome small losses in the wires leading to the magnet.

The super conducting magnet produces a magnetic strength, or flux density, of 43,000 gauss (43,000 lines per sq cm). It has no iron core.

The magnet contains 1/2 mile of wire, about the diameter of a sewing thread. The wire is a niobium-zirconium-base alloy of these two superconducting metals. About 5000 turns of the wire are wound into a coil, or solenoid, 2 inches in dia, 1-1/2 inches long and with a hole 1/2 inch in dia. The coil is immersed in a vessel of liquid helium which keeps it at a temperature near -450F.

The wire carries a current of 20 amps. Special techniques had to be developed to prepare the alloy and take it through the complicated metal processing that resulted in the 10-mil wire.

The superconducting magnet was developed by scientists at the Westinghouse Research Laboratories.

## NYLON Snap Bushings

**NEW From HEYCO.**



**Snap easily and locks into panels of varying thickness up to 1/4" withstands 35 lb. pushback test!**

## Here's a Bushing to meet your requirements

- ◆ Finger pressure assembly
- ◆ Provides complete insulation—it's Nylon
- ◆ Approved for temperatures of 302°F.
- ◆ Not affected by oil or grease
- ◆ Sizes for 1/4" to 2" mounting holes
- ◆ Various inside diameters

### USES:

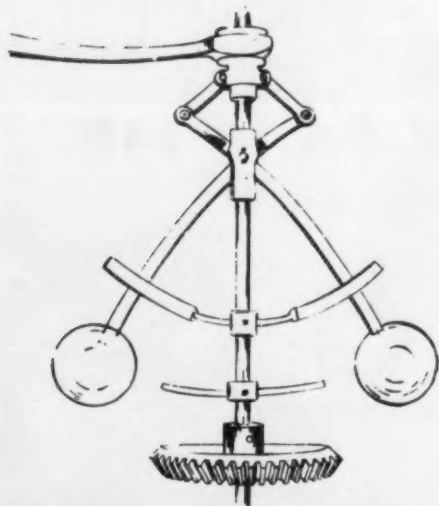
Insulation and mechanical protection for Electrical Wire & Cable, Tubing & Hose, Rope & Cable, Bearing Surface for Moving Parts.



**Samples are FREE**

**HEYMAN MANUFACTURING CO.**  
KENILWORTH 5, NEW JERSEY

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### MILESTONES IN CONTROL & REGULATION

Circa 1769 — Watt's Ball Governor for a Steam Engine/1961 — MECHOHM. Where stepless control of motor speed or torque is a system requirement, MECHOHM represents a significant development in present technology. MECHOHM's combined capabilities replace as many as four components, yet provide superior capability for system control where external disturbances and inherent variables threaten materials "in-process." MECHOHM senses variables, produces resistance changes accordingly to adjust motor speed and torque, and thereby compensates for the variables. Simply defined, MECHOHM is a mechanically actuated variable resistor. But in terms of its unusual capabilities MECHOHM is a linear transducer, a compact high grade power amplifier, a brushless rheostat. As little as 5 grams actuation force is required; cumbersome linkages are eliminated./0.2 inches linear motion controls a full  $\frac{1}{4}$  KW of power—sufficient to cover control range of most motors, without use of amplifiers or short life devices such as limit switches, rheostats or tubes./Resistance is truly stepless. Life is measured in hundreds of millions of cycles. Reliability is a fact. Cost is low. Please write, wire or call collect for additional information.



**ELECTRIC REGULATOR CORPORATION**

Dept. 101, Norwalk, Connecticut □ Tel. Victor 7-2401

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### IDEAS IN THE NEWS

• **NEW BODY TYPES**, based on the 1.5-liter VW, have been announced by Karmann GmbH, Germany. Both the VM convertible and Karmann-Ghia coupe use an aircooled four-cylinder rear engine which develops 45 hp (DIN) at

3800 rpm. The pancake engine leaves room for a rear luggage compartment in addition to space under the hood. Top speed, which is also cruising speed, is more than 80 mph.

R.F.S.



## SYNCHRO NEWS!

### VERNITRON 3-MINUTE CONTROL SYNCHROS DELIVERED ON REGULAR PRODUCTION BASIS

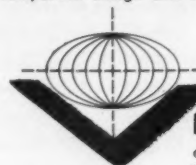
ALL SIZES—11 through 23  
ALL TYPES — Transformers, Transmitters,  
Differential Transmitters — Thru-Bore  
and Standard

ALL ENGINEERED & MANUFACTURED TO:  
MIL-S-2335 MIL-S-16892 FXS-1066  
MIL-S-12472 MIL-S-20708A

ALL AVAILABLE WITH MAXIMUM ELECTRICAL ERROR OF  $\pm 3$  MINUTES! A major break-through, made possible by VERNITRON specialization in precision synchro component design and manufacture.



WRITE, WIRE, PHONE  
NOW for complete  
price, delivery and  
specification data;  
ask for new  
Vernitron Catalog



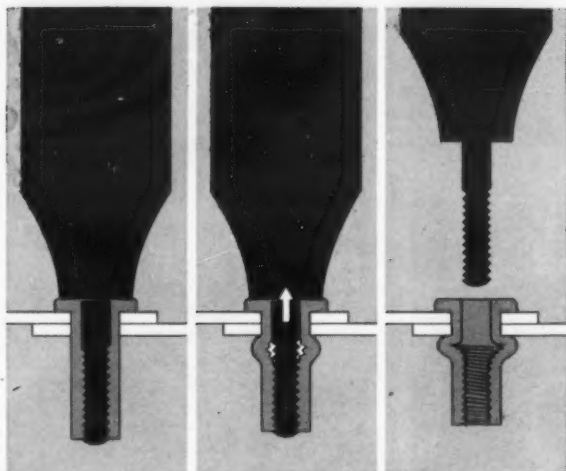
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DESIGN NEWS—OCTOBER 27, 1961





## RIVNUTS® provide sturdy nutplates in seconds...cut assembly time and cost

Simply drill a hole, insert RIVNUTS® on heading tool, upset and withdraw tool. RIVNUTS® provide several internal threads for screw fastening. It's all done from the exterior of the work. For RIVNUT Data Book write Dept. DN-10, B.F. Goodrich Aerospace and Defense Products, a division of The B.F. Goodrich Company, Akron, Ohio. In Canada: Kitchener, Ontario.

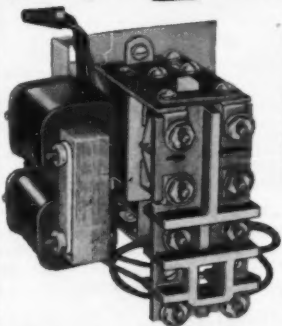


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## WARRICK

Floatless, Electrode Type  
LIQUID LEVEL CONTROLS

give you all these advantages!



No moving parts in the liquid • Easy to install  
• No adjustments necessary • Unaffected by acids or caustics • Unaffected by pressure or temperature • Standard 2&3 pole units listed by U/L

Write for 32-page Catalog which gives complete specifications

Two pole control shown at left

### YOU CAN USE OUR CONTROLS FOR:

- Single & multiple pumps
- Motor & solenoid valves
- High & low cutoffs & alarms
- Sewage & waterworks
- Chemical Industries
- Food & Dairy Industries
- OEM applications

Special controls to custom requirements

**CHARLES F. WARRICK CO.**

1964 W. Eleven Mile Road, Berkley, Michigan  
Dep't 292 Telephone JOrdan 4-6667

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• **ELECTRON FILTER LENS**, developed by the National Bureau of Standards, is suitable for uses as a monochromator, an electron analyzer or a beam-blanking element. The lens maintains an energy resolution of less than the thermionic spread of the initial beam at 5 kev primary energy.

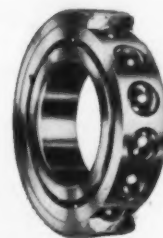
An electron filter lens is an electrostatic lens so designed that electrons having energies above some critical value are transmitted while those with energies below this value are rejected. The critical value is associated with the potential of an electric potential barrier.

The filter lens consists of two short-focus lenses, symmetrically placed about the saddle plane. One lens forms a small image of the entrance aperture to this plane and retards the electrons to the saddle point. This second forms an image of the saddle plane at the exit aperture and accelerates the electrons to their initial energy. The principle of operation of the filter lens is therefore that of two electron immersion lenses placed back to back.

The lens can be used at energies up to 40 kev. In conjunction with a photo-multiplier tube, it becomes a high-resolution electron analyzer. The measured spatial resolution of the lens, when set 1v from cutoff, is 50 microns.

The output of the lens is a well-collimated beam about 1 mm in dia which cuts off without significant change in size. Such an electrode configuration therefore may be useful as a beam blanking element in high-speed cathode-ray tubes.

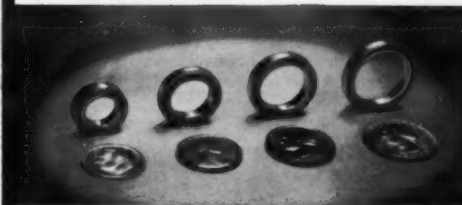
## a new design concept...



**HDR SERIES** High precision radial ball bearings with maximum ball complements in deep groove races uninterrupted by filling slots or counterbore — extra high capacity — made in four metric series, in ABEC 3 and ABEC 5 precision grades.



**T SERIES** Thin-section, high precision radial ball bearings. Type TCR with maximum ball complement and retainer — Type TCF with full race ball complement — Type TWF with unique integral shield.



**MIDGET T's**  
Small, thin-section radial ball bearings with maximum ball complements and one-piece retainers — high concentration of load capacity in minimal space results in tremendous space savings.

## FUNCTIONAL ADVANTAGES EXCLUSIVE WITH PATENTED SBB BALL BEARING CONSTRUCTION

Split Ballbearings have many advantages over conventional ballbearings because of our exclusive and patented method of construction. The result is a new kind of precision ballbearing with the following superior performance abilities:

**MORE LOAD CAPACITY** — up to 56% more radial capacity than conventional Conrad-type bearings while maintaining full thrust capacity in either direction. **LONGER SERVICE LIFE** — up to 280% more life than conventional Conrad-type bearings, without sacrificing load capacity. **ONE-PIECE RETAINER** — strong, light, precision made. **SPACE SAVING** — more capacity in a given bearing envelope means smaller bearings may be used. **LOW TORQUE** — maximum ball complements and precision one-piece retainers provide better load distribution within the bearing, effectively reduce starting torque, and minimize running torque. **GREATER RIGIDITY, LESS DEFLECTION, INCREASED RESISTANCE TO SHOCK LOADS** — all these advantages derive from using maximum ball complements in deep groove bearings without filling notches or counterbored rings... possible only with Split's patented construction method. **INTEGRAL SHIELDS** — truly integral shields in thin-section bearings... no ring distortion. **SPECIAL DESIGNS** — Split Ballbearing's method of construction brings new solutions to difficult bearing problems. As a result, many of these incorporate special bearing designs. You are invited to consult with our Special Bearing Engineering Group for new approaches to your particularly difficult bearing problems.

split ballbearing

**SBB** DIVISION OF **MPB**  
INCORPORATED  
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# Special Motors are Standard AT PEERLESS ELECTRIC!

Need a special motor? Our knowledge may aid in reducing the engineering time. We are the exclusive supplier to many manufacturers for motors with unusual operating conditions and duty requirements. Write us your needs!



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Completely protected against dripping liquids and falling particles.

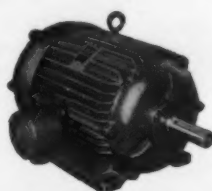


**DIRECT CURRENT**

High starting torque, good over-load capacity and high electrical efficiency. For rough usage.

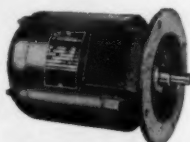


**EXPLOSION-PROOF  
TORQUE MOTOR  
WITH BRAKE**

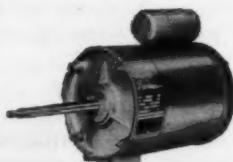


**TEPC and EXPLOSION-PROOF**

External fan draws cool air across motor toward driven machine.



**WEATHER-TIGHT SPECIAL FLANGE**



**SPECIAL FLANGE REVERSING  
HOIST MOTOR, SINGLE PHASE**

**ENGINEERING DATA:** Special mountings. Various modifications—special shaft features; paint and varnish treatments, Class A, B, F, H insulation. Peerless builds to standards and specifications of JIC, AIEE (including AIEE No. 45 Marine Duty), ABS, Federal and Military.

**WRITE FOR BULLETINS:** Space-Saver, SP-1; Torque, T-1; Complete Line, SDA-155. Peerless Electric Division, H. K. Porter Company, Inc., W. Market Street, Warren, Ohio.

**PEERLESS ELECTRIC DIVISION**

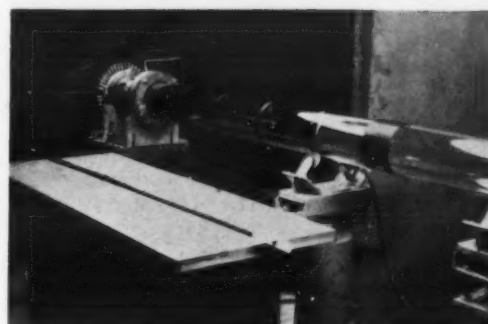
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PORTER SERVES INDUSTRY with steel, rubber and friction products, asbestos textiles, high voltage electrical equipment, electrical wire and cable, wiring systems, motors, fans, blowers, specialty alloys, paints, refractories, tools, forgings and pipe fittings, roll formings and stampings, wire rope and strand.

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## IDEAS IN THE NEWS



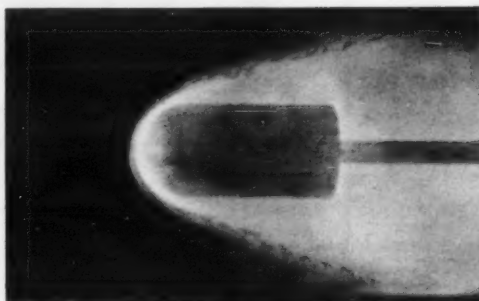
**ELECTROMAGNETIC SHOCK TUBE** has separate capacitor storage bank, capable of storing 60,000 joules of electrical energy. Tube has ID of 6 inches and is 10 ft long. It is operated with initial pressure of 100 microns. Shock wave is driven by electromagnetic forces generated by discharge of tube capacitors.

• **LOW-COST, ALL-GLASS SHOCK TUBE** generates shock wave speeds of Mach 400 (280,000 mph) and above. It is used for laboratory tests of spacecraft re-entry speeds nearly 200 times as great as the swiftest jet fighter.

The use of glass permits direct observation and allows photographic study from any angle of the shock-heated gas radiation patterns. Time exposures can be used to record the entire event or high-speed cameras can record various phases of the wave impact as it passes over scale-model re-entry vehicles of various shapes.

Passage of the shock wave through the gas in the tube heats it to temperatures of the order of 100,000K. Such a hot gas, also called a plasma, radiates a great amount of thermal energy. Study of the process involved in such radiative transfer of energy is an important area in basic physics.

The studies of high-temperature gases and extremely high-velocity re-entry were performed at Lockheed Missiles and Space Co., Palo Alto Calif.



**SIMPLIFIED NOSE-CONE SHAPE** subjected to 280,000-mph shock wave. High-speed gas flow is from left of photo.

**VICTOR**

TYPE  
**K4**



Victoprene on O.D. and outer face; patented lead-in-to-bore feature. Integrally molded element and case.

TYPE  
**K6**



Steel O.D.—Victoprene gasket on inside face. Primary lip retains lubricant; secondary lip excludes dirt, foreign matter.

## PROVEN DESIGN

**compact, dual-lip  
oil seals**

**as narrow as 1/4-inch**

Victor Victoprene oil seals in two types to accommodate varying installation and bore sealing needs, yet provide identical shaft sealing efficiency in even the most limited housing space.

- **DUAL SEALING SURFACES**—Inner lip retains fluid; outer lip excludes foreign matter or confines secondary lubricant.
- **VICTOPRENE ELEMENT**—Developed of improved Buna N synthetic rubber for balanced resistance to lubricants, heat, age deterioration.
- **PERMANENT PRE-LUBRICATION**—Cavity between lips holds lubrication on installation. Reduces frictional drag; extends seal life.
- **NARROW WIDTH**—One-piece integral molded construction for most compact seal housing.
- **POSITIVE SPRING LOCATION**—Molded groove retains spring; uniform pressure on shaft assured. Both types available without spring.
- **POSITIVE BORE SEALING**—Type K4 has bonded-to-case Victoprene on O.D. and outer face; lead-in allows easy installation. K6 has steel O.D. with integral gasket on inside face for bottom of bore seal.

### WRITE FOR CATALOG...

Covers above types and all varieties of Victor oil seals; includes service recommendations. Useful to specifiers and buyers. Victor Mfg. & Gasket Co., P.O. Box 1333, Chicago 90, Ill. Canadian plant: St. Thomas, Ontario.



**VICTOR**

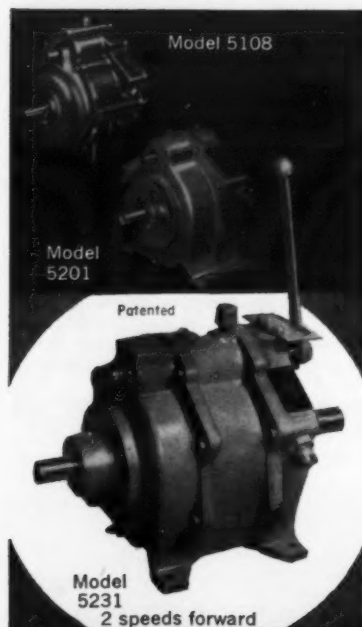
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**OIL SEALS • GASKETS • PACKINGS  
MECHANICAL SEALS**

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# S-N REVERSING TRANSMISSIONS

5 models 8 and 28 h.p.  
with power packed  
versatility



S-N Reversing Transmissions are performance proven, space-saving single units which reverse under full load. Adaptable to the design or redesign of a wide variety of industrial equipment. For technical data write The Snow-Nabstedt Gear Corp., Hamden, Conn.

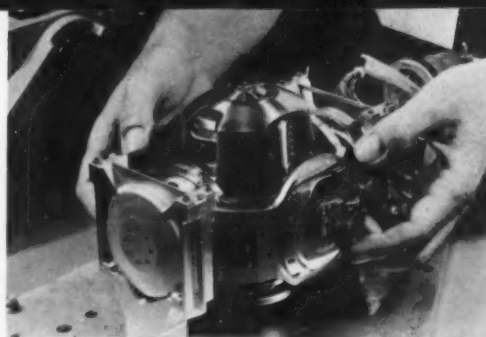
## SPECIFICATIONS

Model No.	5231	5201	5108
Reduction Forward	1.97:1 3.34:1	3.16:1	3.75:1
Ratio Reverse	3.37:1	3.16:1	3.75:1
Power Up To	28 HP	28 HP	8 HP
Max. Input Torque in. lbs.	1000	1000	320
Max. Input Speed RPM	2400	2400	2400
Dimensions	Long 15 1/16" Wide 14" High 14 1/2"	11 1/2" 13 1/2" 14"	9 1/4" 10" 10 1/2"



**SNOW-NABSTEDT**  
Industrial Division  
*Transmission Engineers*  
For Over Half a Century

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• **INERTIAL NAVIGATION STABLE PLATFORM**, one-half the weight and one-third the size of its predecessor, provides all required data for automatic or manual control of orbital or sub-orbital vehicles.

Function of the stable platform is to measure vehicle acceleration and attitude with respect to a desired coordinate system. Gyros maintain an accurate stable reference from which accelerations are measured. When integrated by a computer, these accelerations provide both velocity and position information to the pilot and the automatic control system. Random drift rate for the gyro is 0.001 deg per hour. Estimated operating life is 20,000 hours.

The inertial navigation stable platform was developed by the Guidance and Control Systems Div. of Litton Systems, Inc.

## MEETINGS

Houston, Tex.  
Nov. 9-13

Phoenix, Ariz.  
Nov. 13-16

Kansas City, Mo.  
Nov. 14

Dayton, Ohio  
Nov. 14-15

Clifton, N. J.  
Nov. 14-16

Los Angeles, Calif.  
Nov. 15-17

New York, N. Y.  
Nov. 26-Dec. 1

Washington, D. C.  
Dec. 3-7

**NATIONAL FUELS AND LUBRICANTS MEETING**, Society of Automotive Engineers, Shamrock Hotel.

**SEVENTH ANNUAL CONFERENCE ON MAGNETISM AND MAGNETIC MATERIALS**, American Institute of Electrical Engineers and the American Institute of Physics, Hotel Westward Ho.

**ELECTRONIC SYSTEMS RELIABILITY SYMPOSIUM**, Institute of Radio Engineers.

**FALL MEETING AND SYMPOSIUM ON CERAMICS AND CERMETS**, National Society of Aerospace Materials and Process Engineering, Biltmore Hotel.

**PHOTOGRAPHIC INSTRUMENTATION SEMINAR**, Photographic Analysis Co., 100 Rock Hill Rd.

**NINETEENTH ANNUAL DISPLAY**, Aerospace Electrical Society, Pan Pacific Auditorium.

**WINTER ANNUAL MEETING**, American Society of Mechanical Engineers, Statler Hilton Hotel.

**EASTERN JOINT COMPUTER CONFERENCE**, Institute of Radio Engineers, American Institute of Electrical Engineers and Assn. for Computing Machinery, Sheraton-Park Hotel.

# GAGE PAGE

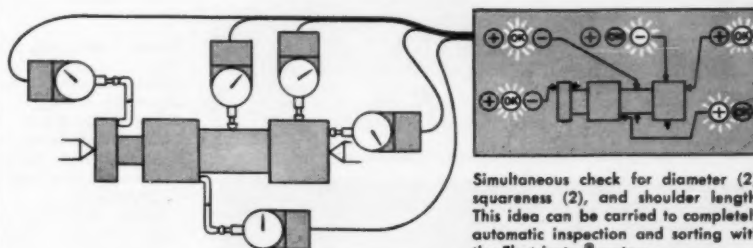
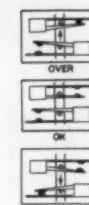
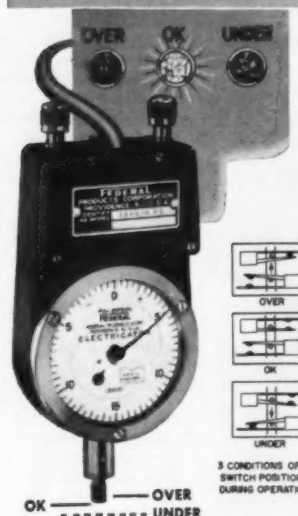
A Quick Run-down of New Gaging Ideas

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## Design News

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IDEAS



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# NEW 15,000-lb Pressure Switch FOR HYDRAULIC SYSTEMS

## Built for Tough Industrial Service—

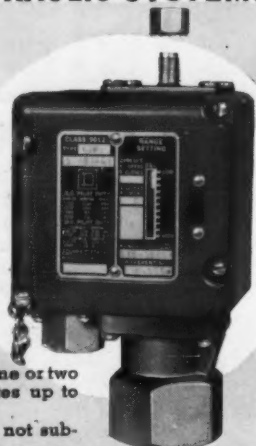
Wide range of pressures  
• adjusts from 2,000  
to 15,000 psi on rising  
pressure

Strain relief • prevents  
damage from shock of  
violent pressure surge  
Oil-tight construction •  
gasketed construction  
prevents entry of oil  
and coolant into switch  
mechanism

Rugged snap-action switch • one or two  
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300 per minute

Long life • pressure element not sub-  
ject to fatigue

Low maintenance • indestructible  
piston, rugged metal case, long-life  
switching member, range-locking nut



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wherever electricity is distributed and controlled

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## Order Eaton Caps and Filler Necks from STOCK

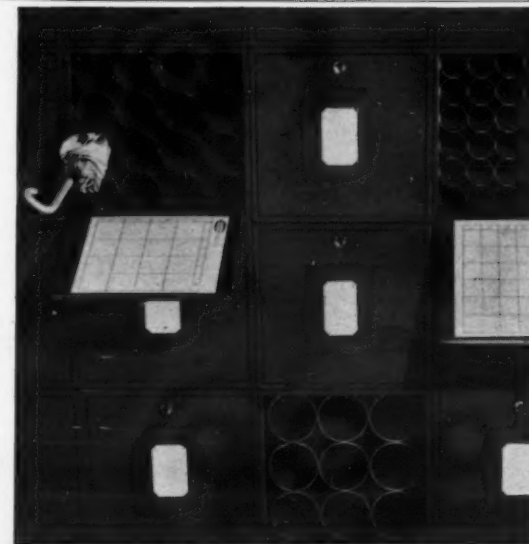
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DESIGN NEWS—OCTOBER 27, 1961

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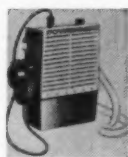
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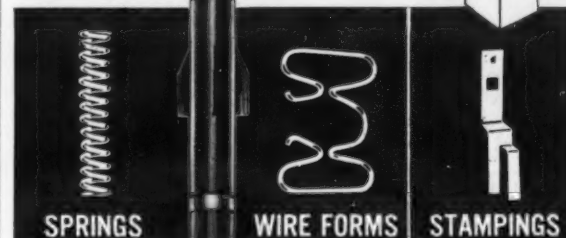
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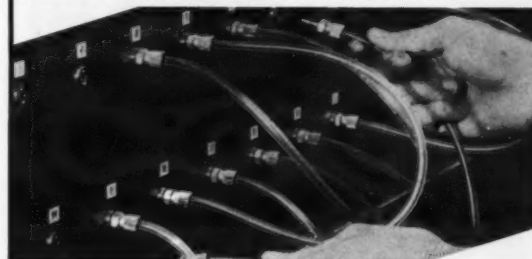
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DESIGN  
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NEWS

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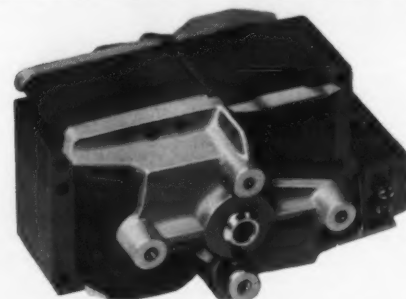
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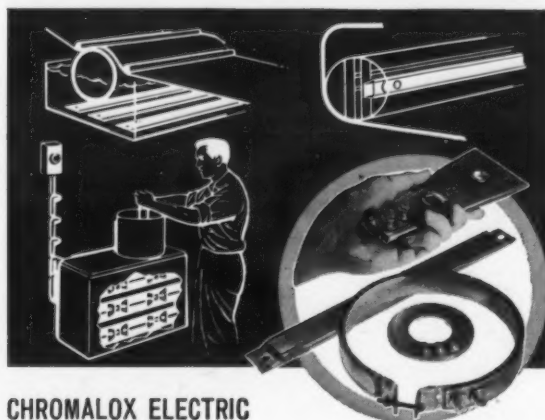
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## PLANS AND CROSS-SECTIONS

### 'Honest, Officer It Just Popped Up'

Automatic street markers that can alter complex traffic patterns within 10 sec are designed to pop up from the pavement or disappear beneath it. Made of silicone

rubber developed by General Electric, they can be controlled by time clocks, radar, radio or the simple flick of a switch. If hit by careless motorists, they quickly snap back into position. A built-in heater keeps the markers from freezing in winter. The system, called Movatron, is marketed by Nationwide Traffic Engineering Products.



'Nothin' to it. I told him he had to finish that gear before he left or else.

### Just the Thing for Pocketbook Editions

Don't throw away your pencil and paper yet, but a collapsible typewriter, small enough when not in use to be carried in a briefcase "or even inside a coat pocket," has been patented by a Swiss inventor, Marcel Fresard of Geneva.

In its compressed state, the machine is less than half of its full operative size. It forms a portable package approximately 10 inches long, 5 1/2 inches wide, and 1 1/4 inches high.

When the typewriter is open, the keyboard is of standard size and shape. When the casing is collapsed, the cover and the key bars are moved up and over to fit into place against the type bars and connecting rocker levers.

### Stainless Suits

Garments made of steel may be standard items in clothing stores of the future.

This does not mean that everyone will be wearing armor plate. Dr. Henry E. Millson, American Cyanamid Co. textile chemist, said soft, drapable fabrics may be woven from stainless-steel wire so fine-drawn that it is only 1/2 the thickness of a human hair.

Dr. Millson also envisions aluminum-coated summer clothing to keep the wearer cool, and winter clothing with inner linings that can be removed to collect solar energy for warmth.

He added that knitted and woven paper garments, treated with resins and finishes so they can be washed and dry cleaned, may be "the answer to the clothing problem in low-income countries."

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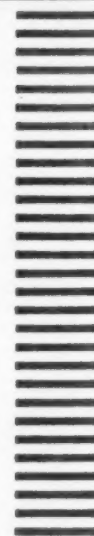
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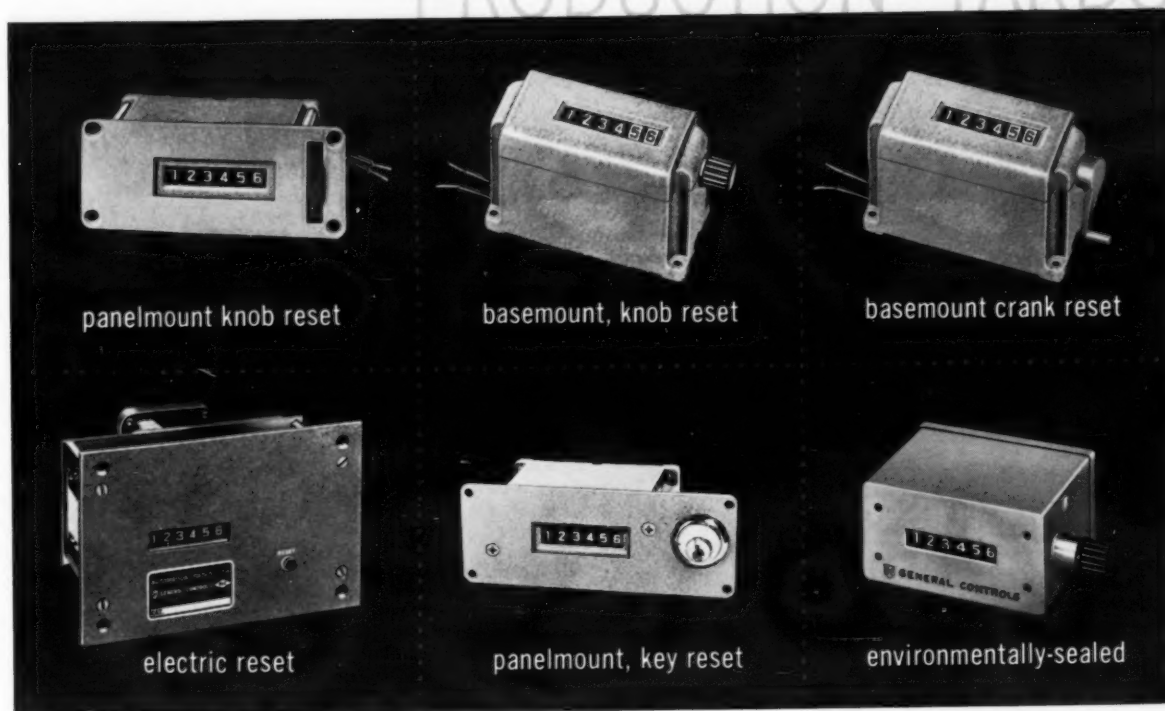
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